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Safety procedures are outlined for the following sports: (1) fishing; (2) hunting and shooting; (3) skeet and trap; (4) hiking and mountaineering; (5) ice fishing; (6) ice skating; (7) skiing; (8) snowmobiling; (9) recreational motorcycling; and (10) developmental and play activities. (JD)

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Safety in Outdoor Recreational Activities

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Monograph #6

Sports Safety Series

Co-Editors
Joseph Borozne
Chauncey A. Morehouse
Stanley F. Pechar

U S DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

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Washington, D.C. 20036

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Foreword

This last of the monographs in the *Sports Safety Series* deals with many of the more popular outdoor recreational activities in which safety is a vital concern. No claim can be made that this covers all of the activities or even all of the most important ones because of the wide variety of activities which can be classified under the broad term, *recreational sports*.

The publication of this monograph completes the planned revision of the textbook, *Sports Safety*, which was originally published by the Safety Education Division of the American Association for Health, Physical Education and Recreation (AAHPER). The American School and Community Safety Association (ASCSA), which replaced the Safety Education Division as an association in the restructured American Alliance for Health, Physical Education and Recreation undertook the task of editing this revised series in sports safety nearly two years ago. The number of contributors involved in the complete series made it impractical to finish in a shorter period of time.

With the completion of this monograph, ASCSA will make available a single volume containing all six monographs comprising the *Sports Safety Series* as originally planned. For individuals with more restricted interests each monograph may also be purchased separately.

The monographs within the *Sports Safety Series* are:

#1 *Administration and Supervision for Safety in Sports.*
#2 *Accident Surveillance Systems for Sports.*
#3 *Safety in Team Sports.*
#4 *Safety in Individual and Dual Sports.*
#5 *Safety in Aquatic Activities.*
#6 *Safety in Outdoor Recreational Activities.*

The ASCSA and the Co-editors thank the many individuals who contributed not only to this monograph but also to the other monographs comprising the Series. The names of these contributors with their current addresses are listed in the publication which contains their contribution. Without the cooperation and efforts of all of these professional people the completion of this project would not have been possible.

Joseph Borozne
Chauncey A. Morehouse
Stanley F. Pechar
Co-Editors
Sports Safety Series

EDITORIAL COMMITTEE

Joseph Borozne
Associate Professor
Department of Physical Education
Boston University
704 Commonwealth Avenue
Boston, Massachusetts 02215

E. Lee Dennis
Associate Professor
Department of Physical Education
Brooklyn College
Bedford Avenue and Avenue H
Brooklyn, New York 11210

Harold Liebowitz
Assistant Professor
Department of Physical Education
Brooklyn College
Brooklyn, New York 11210

Chauncey A. Morehouse
Professor
Sports Research Institute
The Pennsylvania State University
University Park, PA 16802

Stanley F. Pechar
Associate Professor of Education
School of Education, Health, Nursing and Arts Professions
New York University
New York, New York 10003

TABLE OF CONTENTS

	Page
Foreword	iii
Editorial Committee	iv
List of Contributors	vi
Chapter	
1. Fishing — Julian Smith	1
2. Hunting and Shooting — Louis F. Lucas — Revised by H. Wayne Sheets	4
3. Skeet and Trap — H. Wayne Sheets	13
4. Hiking and Mountaineering — Gordon E. Howard	23
5. Ice Fishing — Ottar G. Draugsvold	39
6. Ice Skating — Kurt Oppelt and Cathleen Oppelt	44
7. Skiing — Jack M. Toney and James G. Garrick	47
8. Snowmobiling — Henry V. Ziminski	55
9. Recreational Motorcycling — A. E. "Joe" Florio	59
10. Developmental and Play Activities — Anita Aldrich	63

LIST OF CONTRIBUTORS

Aldrich, Anita Ed.D
Professor of Physical Education
Indiana University
Bloomington, Indiana 47401

Draugsvold, Ottar G. MEd.
33 Fuller Street
Magnolia, Massachusetts 01930

Florio, A. E. "Joe," Ph.D.
Professor Emeritus
Department of Health and Safety
College of Applied Life Studies
University of Illinois
Champaign, Illinois 61820

Garrick, James G., M.D.
Affiliated Bone and Joint
Surgeons P.C.
333 East Virginia — Suite 101
Phoenix, Arizona 85004

Howard, Gordon E., Ph.D.
Professor
College of Forest and Recreation Resources
Department of Recreation and Park Administration
Clemson University
Clemson, South Carolina 29631

Lucas, Louis F.
National Rifle Association
Washington, D.C. 20036

Oppelt, Cathleen, M.S.
530 Westgate Drive
State College, PA 16801

Oppelt, Kurt, B.S.
Assistant Professor
Department of Physical Education
The Pennsylvania State University
University Park, PA 16802

Sheets, H. Wayne
Director, Education and Training Division
National Rifle Association
Washington, D.C. 20036

Smith, Julian W. (deceased)
Outdoor Education Project
Michigan State University
East Lansing, Michigan 48823

Toney, Jack M.
Division of Sports Medicine
University of Washington
Seattle, Washington 98195

Ziminski, Henry V. (retired)
Formerly Assistant Director,
Recreation and Lands
U.S. Forest Service
Ogden, Utah
Home address
3074 North 550 East Street
North Ogden, Utah 84404

Chapter 1

FISHING

Julian W. Smith
Michigan State University

Fishing is one of the most popular outdoor sports. The simplicity of equipment and relative solitude of lakes and streams in America offer a safe and relaxing sport for millions of people. Most of the potential fishing hazards are related to a lack of swimming skills and improper use of boats, especially motorboats.

Fishing in Boats

Regardless of life jacket equipment, fishermen using boats should have sufficient skills to swim fully clothed. While most accidents in and on the water result from carelessness, slippery boat bottoms, or overloading, there is always a possibility of sudden storms and boat collisions.

Many of the safety precautions relating to boats are discussed in Monograph #5 of this series on sports safety. However, since most fishing accidents involve boats, some of the accident causing situations are described here.

Moving about in a boat. Unexpected movements due to excitement, landing fish, or casting an anchor may cause boat occupants to fall overboard or capsize the craft. If it is necessary to stand in order to keep a line from fouling, fellow fishermen should remain seated to keep the boat on an even keel. When moving forward to hoist anchor, one should step on the bottom to maintain stability, not on the seats of the boat. The body should be kept low with one or both hands on the gunwale. Care should be taken in hoisting the anchor when it is fouled in weeds or mud to prevent water from coming in over the sides.

Standing in a boat is always risky, especially in rough water or when trying to get unhooked after a bad cast. There is always danger of the boat hitting a snag or of having the motor thrown accidentally into reverse.

Operating the motor. Stepping into a boat while holding a motor may cause loss of balance or the dropping of the motor. The motor should be on the dock edge before entering the boat; then, with feet apart, it may be swung into the boat and over the transom. When pulling the starter rope, the operator and all other persons in the boat should be seated. Hard to start motors need to be checked by servicemen to guard against engine failure; a breakdown could be tragic in storms or darkness. The operator should never use the motor as a seat. When the boat is running at full throttle, boat occupants should be watchful for rocks, snags, and floating debris.

Fishermen using motorboats on larger bodies of water should have full weather information. If a storm threatens while the boat is out on the water, the operator should return the boat to shore immediately.

In the event a boat should overturn, the cardinal rule calls for staying with the craft rather than attempting to swim ashore. Following a quick check to see that all persons are accounted for and floating equipment is secured, the craft should be righted and hand-paddled, if necessary,

to the nearest shore. Lost equipment may be salvaged later. A gas tank, even though filled, will float and support an average sized person.

Night time anglers will need running lights and state regulations should be checked and complied with to insure the safe conduct of water craft at night.

Safe boats and needed equipment. Boat manufacturers use a standard formula for setting a safe capacity, which is usually displayed on a permament transom plate. Heed the total load rating, not only the numbers of persons, because the weight of motor and gas can exceed the weight of one person.

The Coast Guard, as well as most states, requires a life preserver or buoyant cushion for each occupant in a boat. Many fishermen do not use life preservers because they are hot and bulky, and rely instead on cushions. Weak swimmers, however, should not depend on cushions, but should use a life preserver at all times.

Safe and courteous handling of motorized water craft is of extreme importance in multiple-use areas. Swimmers, skiers, surfers, and scuba divers often occupy the same body of water. Water craft should be operated at minimum speeds to insure maximum control in congested areas. Anglers should be familiar with the red and white flag which marks the presence of scuba divers. Such markers should be given a wide berth for a churning propeller could become quite lethal.

Caution must be always exercised around gasoline. Do not smoke when refilling tanks and be careful when wiping spills.

Drinking liquor is no more compatible with the operation of a motorboat than with an automobile.

During the 1974 fiscal year, the Bureau of Epidemiology of the Consumer Product Safety Commission received reports from hospitals on injuries from fishing tackle. This included injuries involving poles, lines, lures, hooks, knives, scalers, nets, tackle boxes, etc. In that category, 1,555 injuries were reported, with a ranking of 44th out of 369 listed on the Consumer Product Safety Hazard Index. However, almost all injuries reported were very low on the severity index with most injuries being the result of user carelessness rather than inherent safety defects in the equipment.

Use of Fishing Tackle

Hooks rank second to boats as causes of fishing accidents. Improper form, such as sidearm casting when there is more than one person in the boat, is the chief cause of accidents with lures. Overhead casting is not only safer but is more accurate. However, any form of casting can cause accidents when the backcast is in the direction of other boat occupants. The proper form is to cast at right angles from the boat.

When removing weeds or changing lures, release enough slack line so that it is not under tension. A bowed rod can snap a hook into a finger or other part of the body. All hook removals should be made by a doctor. However, in the event a hook penetrates past the barb and no doctor is available, it should be pushed through the flesh so that the barb can be removed with side cutters. Side cutters should be a standard item in every tackle box. A wound caused by a hook should be treated with antiseptic, another important item for a tackle box. It is advisable to seek medical attention whenever possible when hooks are involved in a fishing injury.

Handle fish carefully, especially those with sharp teeth and fins. Some fish, such as muskies, should be stunned with a club before gaffing or immediately upon being brought into the boat. Long nosed pliers, an important tackle box item, are useful in removing gang hooks from fish.

Stream and Bank Fishing

The main danger in stream fishing is wading in water of unknown depth, especially when the fisherman is wearing boots and heavy clothing. Slippery stones and logs are also hazardous.

Felt soled footwear are a safety precaution on slippery stones. A wading staff is helpful in swift running water and floatation gear is highly recommended when wading.

Ice Fishing

The increasing popularity of ice fishing has created a need for safety procedures, especially for those with little experience on frozen lakes and streams. An ice fisherman should always check ice for strength and thickness. Four to six inches of solid ice is sufficient for a few fishermen in a small area, but is not enough for fish shanties or for driving cars on the ice. Fish shanties are small, crude structures such as a tent or wood shack, which fishermen set up on the ice to protect themselves from the cold and wind while they fish. Using cars on ice is recommended only in very cold climates where the thickness of ice is measured in feet instead of inches. In all ice fishing, fishermen should stay a safe distance from openwater, inlets and outlets, and springs.

Ice fishermen should not leave debris on ice which later in warm weather could cause danger in swimming and boating areas. Fish shanties must be removed from the lake or stream before the ice becomes unsafe through melting. When fishing in a heated ice shanty, check for proper ventilation. Homemade heaters are dangerous because of their fumes and fire.

Fishing Education

As with sports, the best safety guarantee in fishing comes through developing competent skills. Important, too, is that fishermen constantly inspect their boats and tackle. Teaching casting and angling in schools and youth agencies can make fishing a safer sport. Local casting and angling clubs also can further the goal of improving skills and safety in fishing.

Chapter 2

HUNTING AND SHOOTING

Louis F. Lucas
National Rifle Association of America
Revised by H. Wayne Sheets, National Rifle Association of America.

Hunting is one of the oldest outdoor sports. It has been practiced out of necessity or for sport since man first armed himself with clubs and stones. Today, it is among the most popular outdoor recreational activities. Recent reports indicate that over 16 million people bought 25 million different types of hunting licenses in 1976.

Hunting and informal shooting require knowledge, skill, and judgment by those who would participate safely. Diminishing open spaces and increasing population have almost eliminated the places where a shot can be fired without the possibility of another person being within range.

Hunting Accidents

Firearm accidents. Hunting accidents involving firearms are of two types: those in which the gun is fired deliberately and those in which the gun fires accidentally.

Accidents stemming from a deliberately fired gun occur in different ways: (a) the hunter shoots another person when he is firing at a moving target; (b) the hunter mistakes another person for game; (c) the hunter fires in the direction of a sound or a movement without first identifying the source; (d) a bullet ricochets; (e) a bullet goes beyond the target and strikes an unseen person; (f) the hunter fails to make certain that the gun was unloaded; and (g) the hunter uses the wrong ammunition or a faulty gun.

The gun can fire accidentally also in a variety of circumstances: (a) the gun is faulty and fires when dropped or bumped; (b) the hunter slips or falls and fires the gun unintentionally; and (c) the hunter has the gun completely ready to fire and the trigger is caught on a limb, barbed wire, or other similar object.

Bow hunting accidents. Hunting accidents with archery tackle parallel those with firearms since, in both cases, the hunting instrument shoots a projectile. Bow hunters are subject to the same mistakes in judgment as hunters who use rifles and shotguns. The arrow ricochets or goes beyond the target and strikes an unseen person. The bow can also shoot its arrow accidentally. The arrow is carried in the cocked position with tension on the bowstring. The hunter's fingers slip. The bow is faulty. There is one additional hazard in archery hunting equipment that does not figure in gun hunting equipment. The projectile is hazardous even when at rest. The bow hunter must treat his arrow in much the same way he would treat a handful of razor blades.

Statistics. Although statistics do not prevent accidents, they do provide information on how accidents happen and can guide in the designing of accident prevention programs.

Statistics on hunting accidents come from two sources, the *Uniform Hunter Casualty Report* and the *Accident Facts* (6, 7). The former deals with the number of fatalities annually. The latter analyzes the types of accidents, conditions under which they happened, percentage of

fatal and nonfatal accidents, ages of those involved, type of hunting arm, range, and other pertinent data. The Uniform Hunter Casualty Report Form defines a hunting accident as "a hunter casualty in which a person is injured by the discharge of a hunting firearm outside of the home and arising from the activity of hunting, including travel to and from the hunting field".

According to *Accident Facts*, there were 900 deaths from firearm accidents in public places, including hunting accidents during 1977. The report excludes deaths from explosive material. The report indicates that 55 percent of the accidents involved individuals, aged 15 to 44 years.

The 1971 Uniform Hunter Casualty Report analyzed 2,230 accident reports, of which approximately 12 percent concerned fatalities. Shotguns accounted for 58 percent of the accidents. In 42 percent of the accidents, the victim was 30 feet or less from the gun. In 17 percent, the victim was 150 feet or less from the gun. Self-inflicted wounds accounted for 34 percent of the accidents.

More accidents occurred during deer hunting while quail hunting had the second highest accident rate. Rabbit hunters followed with the third highest number of accidents. The majority of hunting accidents occurred when the victim: (a) moved into the line of fire; (b) was covered when shooter swung on game; (c) was out of sight of shooter; (d) was mistaken for game; or (e) stumbled and fell. Other accidents involved the following situations: (a) clubbing cover or game; (b) trigger caught on brush or other object; (c) removing firearm from or placing in vehicle or boat; (d) riding in vehicle with loaded gun; (e) firearm falling from insecure rest; (f) "horseplay"; (g) gun thought to be unloaded; (h) crossing fence or other obstacle with loaded firearm; (i) loading; (j) unloading; (k) defective gun; and (3) ricochet-stray bullet.

In total accidents, 35 percent of the shooters were 19 years old or younger. Interestingly, 23 percent of the victims wore bright, prominently colored clothing.

Hunting Equipment. Accident prevention programs must concentrate on educating potential participants. These programs should teach what equipment to use, how to use it, to be aware of potential hazards, and how to avoid dangerous mistakes.

Any training program for accident prevention in hunting should influence the attitudes of the hunter. Unless the participant regards hunting as a game having rules of conduct which are as rigid as those controlling baseball, football, or basketball, his skills will be of little use to him.

A nationwide program of hunter safety training has been in operation for more than 25 years. In 49 states and most Canadian Provinces, the Game and Fish Department (or its equivalent) provides statewide hunter safety training programs with the cooperation of the National Rifle Association of America. These programs have trained over eight million hunters, predominantly young people under 20 years of age. They have also become a part of the physical education curriculum in numerous schools and colleges.

Guns and bows. Hunting safety begins with a thorough knowledge of the implements. Popularity ranking of hunting instruments is as follows: shotgun, rifle, bow and arrow, handgun.

While rifles and pistols have barrels which differ in length, other characteristics are similar. The bore (the hole which runs lengthwise through the center of the barrel) has rifling in it. Rifling consists of a series of grooves which spiral from the breech through the bore to the muzzle, the place where the bullet comes out. These grooves cause the bullet to spin on its own axis and stabilize it in flight. The comparatively predictable course of a football which has a tight spiral as against one which does not is a common example.

The shotgun, on the other hand, has no grooves in the bore. This is because the shotgun is designed to shoot a number of shot (round pellets) at the same time and they spread out to make a pattern in flight. Also the wall of the shotgun barrel is considerably thinner than that of the rifle or handgun.

The *action* of a gun is that group of parts which carries the cartridge or shotshell into the chamber, fires it, and removes the fired cartridge case. Each action has a handle which the

shooter can operate. In bolt action rifles, for instance, the bolt handle is used to open and close the action. Even semi-automatic actions, which insert a fresh cartridge and remove the used case after firing, have an external handle with which the shooter can open the action. Each action has an external projection by which it can be operated.

There are several actions which are common to hunting firearms. These are: bolt, lever, semi-automatic, hinge, slide (or pump). In each case the name describes the mechanical means by which the action operates. The bolt, for instance, locks shut and opens just as a door bolt does. The hinge action is most frequently found in shotguns. These guns "break" on a pivot, or hinge, at the breech end of the barrel. The breech is exposed and the shotgun shells are put in place by hand. When the gun is hinged shut, the shells are locked into the closed breech. The other terms bear the same relationship to the actions they describe.

Handguns are not commonly used for hunting. They are difficult to shoot accurately and their range is short. The two common types of handguns are the revolver and the semi-automatic. Again, the name is descriptive of the operation of the action. In a revolver, the cylinder revolves each time the trigger is pulled. The revolution of the cylinder brings a fresh cartridge into line with the barrel. When all cartridges have been fired, the empty cases are removed from the cylinder and fresh ones inserted in the chambers.

Semi-automatic actions are common to handguns, rifles, and shotguns and operate in the same way. Every semi-automatic action requires a magazine, a receptacle that holds ammunition and feeds a fresh cartridge into the action each time the gun fires. With the magazine loaded and the action closed, the gun is ready to operate semi-automatically. Each time the trigger is squeezed, the gun fires; it does not fire continuously. It will not fire the fresh cartridge until the trigger is released and squeezed again. Part of the energy released by the burning powder opens the action, ejects the fired cartridge case, and places a fresh cartridge in the breech. The gun is then ready to fire again.

Modern hunting bows are usually recurved, but the straight-limbed bow is still seen occasionally. Straight-limbed bows are almost arc-shaped when strung but the recurved bow has tips which curve again, out of the basic arc-shape, and away from the archer. The recurved bow is easier to draw than a straight-limbed bow of the same weight and has better cast, that is, it drives the arrow faster. The users of the straight-limbed bow claim that it offers more accurate shooting.

Bows used to be made of different types of wood. Solid wood bows, however, have almost disappeared from the archery scene. Bows are now made entirely of fiberglass or of a lamination consisting of several layers of wood and fiberglass.

Hunting bows come in different "weights". This term indicates the number of pounds of force required to draw the bow fully. Bow weights run from 30 to 75 pounds, but the average hunting bow is somewhere between 40 and 60 pounds. Bows also differ in length.

Every potential hunter should have complete familiarity with the gun or bow with which he expects to hunt. He should be so at ease with this equipment that his manipulatory skill is not only perfect, but comes naturally. He can then devote his mind entirely to the situation at hand.

Ammunition. Firearm ammunition should be considered almost as a part of the gun itself. The sizes of guns are described in terms of calibers for rifles and handguns and gauges for shotguns. Gauge is the number of lead balls and the diameter of the bore, which would weigh a pound. Calibers are expressed in one-hundredths of an inch. For instance, .22 caliber means 22/100. All cartridges of the same caliber do not fit a rifle or handgun designed for that caliber. Differences in the case or the amount of powder with which it is loaded may make a certain cartridge unsuitable, or even dangerous, for use in a firearm. In short, the cartridge must be the one specifically designed for use in a particular gun. When proper ammunition is used in a gun which is in top operating condition, the possibility of a "blown" gun is virtually eliminated.

Types of ammunition for sporting arms are much alike. Each type consists of four basic parts:

primer, case, powder, bullet (or shot). There are two basic types of cartridges, rimfire and centerfire. These terms designate the location of the primer and do not indicate any differences in the components which make up the cartridge. The cartridge used in the common .22 caliber rifle is rimfire. Larger caliber cartridges are centerfire. The case is the container for all of the components. The primer furnishes the ignition. The powder burns and the resulting gases, which expand very rapidly, push the bullet or shot from the barrel of the gun. The operation is similar to that of the spark plug, gasoline vapor, cylinder, and piston in an internal combustion engine.

Shotshells differ from rifle and pistol ammunition in that they include wads which separate the powder from the shot. When the shell fires, these wads push the shot charge through the barrel of the shotgun.

There are many hunters who make their own ammunition, a process called reloading. A cartridge case in good condition may be used a number of times. Reloading requires a thorough knowledge of the type and amount of powder which goes into a certain load. It also requires scrupulous attention to detail on the part of the reloader. Carelessness can create the risk of wrecking the gun and injuring the shooter.

Gunpowder comes in various sizes and shapes. These characteristics, as well as its chemical composition, control the speed at which the powder burns. The burning rate is important to safety. A given amount of a fast burning powder will create greater pressures than an equal amount of a slower burning powder. Casual experimentation with reloading can cause trouble. Priming compounds are stable but touchy. Cartridges should not be struck or exposed to great heat. However, they are completely safe when handled properly.

Arrows should be mated to the bow with which they will be shot. Matching the arrow with the bow is called spining. Arrows which perform well when shot from a 30-pound bow may perform poorly when used with a bow of a different weight.

Arrow shafts are made from several different materials, the most common of which are wood, aluminum, and fiberglass. Wooden arrows are still widely used but the other materials, although more expensive, are less subject to breakage and warping. Arrow length varies and is related to the length of the bow arm of the shooter. Generally, men shoot 28-inch arrows and women and young people use 26-inch.

The parts which make up an arrow are: shaft, head, nock, fletching. The nock is the slot at the rear end of the shaft into which the bowstring fits. Fletching consists of feathers (or equivalent) just ahead of the nock. The feathers are fastened to the shaft along spiral lines and cause a stabilizing spin in flight. One of the feathers serves as a cock feather and stands perpendicular to the bowstring when the arrow is nocked. It is usually a different color. The tip of the hunting arrow is called a broadhead. Broadheads are made in a variety of designs but fall into three general designations. The single-blade is a one-piece point with the two edges sharpened and comes in numerous shapes. The bodkin is three-bladed. The multi-bladed point has four or more cutting edges.

While firearm ammunition is entirely safe under normal handling conditions, broadheads are inherently dangerous because of the razor-sharp cutting edges. They should be handled carefully when they are examined, repaired, or drawn from the quiver (the carrying container for the arrows). The design of the quiver is quite important since it should protect the hunter from his own broadheads. The hunter must guard against injury when drawing a broadhead from the quiver in the field.

Safety mechanisms. Many types of firearms, especially those used in hunting, have some sort of a mechanical safety. Too often, the safety is a source of false confidence for hunters. Since it is a mechanical device, it can fail. It should never be considered a substitute for safe gun handling practices. Safeties do, however, have their place in gun handling. When the gun is loaded and ready to fire, it should be kept on "safe" except when a shot is imminent. Proper use of the safety will help avoid accidental discharge of a gun.

Although the bow does not have a safety, accidental shooting can be avoided. An arrow should not be nocked with the bowstring pulled. Even that slight tension is sufficent to propel an arrow several yards if released accidentally.

Cleaning, inspection, storage. Learning about hunting should involve developing an appreciation for the firearms as objects. Modern sporting arms are mechanical works of art; they have fine finishes and exhibit excellent craftsmanship. With regular maintenance and proper care, they should last a lifetime.

Close examination of guns, ammunition, and bows and arrows should be made before use. Guns should be checked, while unloaded, to insure proper functioning and that there is no obstruction in the barrel. Between seasons, they should be checked periodically to prevent rust. Check ammunition before going to the field to be sure that it is clean and free of defects. Sometimes the primer is not fully seated, and high primers can cause jamming of the action or even accidental discharge of the firearm. They are fairly easy to detect by touch or sight. Reloaded ammunition should be inspected carefully for cracked or malformed cases.

Archery equipment should be inspected closely. Cracked bows or arrows are potential sources of injury. Frayed bowstrings may break and cause erratic or unintentional flight of the arrow. Sudden release may also break the bow. Arrows should be checked for sharpness, cracks, secure fletchings, and damaged nocks.

After use, inspect hunting equipment for damage and clean thoroughly. Guns should be oiled lightly, inside and out. Excessive oil can collect dust and lint which, in turn, attract moisture. Excessive oil also seeps into the wooden parts and causes deterioration. Archery tackle should be inspected closely and cleaned. The bowstring should be waxed periodically with special wax made for this purpose. The bow should be checked for dirt between the tips and the string.

Wide ranges of temperature and high humidity are the enemies of guns, ammunition, and archery equipment. Find a storage place where the temperature is even and the humidity is constant and moderate. To protect children, store guns in a locked gun case, closet, or similar place. Ammunition should be locked up separately.

Guns should be stored completely unloaded (breech and magazine). The action should be closed and the gun uncocked. Bows should be unstrung and hung up for storage. Broadheads should not be left in the quiver for long periods of time because accumulated moisture can cause them to rust and warp. They should be stored in the box in which they were packed originally, or one similar to it, since it offers support at both ends. Broadheads should be locked up out of the reach of children.

Shooting

Marksmanship training develops manipulatory skills and gives the hunter confidence in his ability to hit the target.

If the delivery of a shot to a precise point involves an unusual risk, the shot should not be fired. External stimuli, rather than lack of shooting skill, could cause a shot to go wide of its mark. Skills involved in accurate shooting are not learned quickly. Sources on "how to shoot" are listed at the end of this chapter.

Rifles and handguns. The elements which determine the course of a bullet from a rifle or handgun are the same in spite of the fact that the two guns differ in size. The theory behind shooting is simple — the sights of the rifle or handgun are aligned and the gun is fired without disturbing that alignment. This condition is difficult to achieve in any setting but a laboratory. When the gun is picked up to shoot, the movement of the body, involvement of certain muscles, eyesight, trigger finger control, breath control, and other elements affect the point at which the bullet strikes the target. The key to the process is proper alignment of the sights.

Sights used on hunting guns are either *open* or *telescopic*. Open sight components include a front post sight which is located at, or near, the muzzle of the gun. The rear sight, a notch which

may have any one of several shapes, is located near the breech end of the barrel. Hunters should *sight in* their guns. Sighting in involves firing a number of shots at a target at a known distance. The hunter, after suitable adjustments of the sights, gets *on target*. Alignment of the sights involves holding the gun so that the front sight appears to the eye to be precisely in the center of the rear sight. The top of the front sight should be in the same plane as the top of the rear sight. Most hunters sight in their guns in such a way that the shot hits the spot at which the top of the front sight appears on the target. Telescopic sights make sight alignment simpler for the hunter. The sighting in process gets the telescope into alignment with the gun. The hunter simply looks through the telescope and the shot is fired when the crosshairs or post are in the proper relationship to the target.

The trigger is *squeezed* when a rifle or handgun is fired. Sudden actuation of the trigger will cause movement of the gun and the shot will be wide of the mark.

Stability of the rifle while the trigger is being squeezed has much to do with an accurate shot. In target shooting there are rigid rules about how this stability may be obtained. Artificial support is illegal. The shooter must use body conformation and a rifle sling to achieve stability. The hunter, however, is not restricted by such rules. In fact, he should use any artificial support available to him. If there is no artificial support, the shooter should use his own body for support. When muscles alone are used, a tremor usually results. The arm supporting the gun should be directly under it. If the hunter is standing, the supporting arm can be propped against the body for additional support; if kneeling, the supporting arm should be propped on his knee. When the hunter can find a fence-post, a limb, or other support to lean against, the arm is still used to support the rifle — it is not rested directly on the support. Ordinarily, in handgun shooting, no support is allowed. Even the free arm is not used. In hunting, however, the chances of an accurate shot are considerably improved if support is used.

The hunter also must learn to control his breathing. Just before the shot, fill the lungs with air. Enough air should be exhaled to allow holding the breath comfortably for a few seconds. Active breathing must be halted while the trigger is being squeezed.

Through practice, physical requirements for delivering an accurate shot can be molded into a familiar, nearly automatic pattern. Practice also increases the manual skills needed for safety.

Shotguns. When shotguns are used as rifles, with rifled slugs on big game, they are fired in the same way as rifles. Shotguns used for this purpose often have sights similar to the open sights used on hunting rifles. The technique for shooting accurately is the same as that used with the rifle.

Most shotguns are used on moving targets, and the shooting technique is entirely different from that of rifles. Sights are not used. Some shotguns have a small bead at the muzzle end of the barrel which serves only as a means for locating the end of the barrel. The shotgun is pointed rather than aimed. The shotgun is mounted to the body in such a way that, during shooting, the body and gun move as though they were one piece. The eyes do not move independently, but instead become the guide for the entire upper portion of the body. The gun follows the body. This is what is meant by pointing.

The shooting stance for shotgunners is very similar to the stance used by boxers. Placement of the feet is important; the leading foot should point in the same direction that the shot is to be fired. The body is inclined forward slightly. The hand supporting the shotgun is forward. The supporting hand keeps the muzzle swinging with the eyes and body. In fact, many shotgunners place the hand under the gun in such a way that the forefinger actually points. The hand then moves as if it were pointing out the target.

The *lead and swing* technique is the most widely used leading device, especially for beginners. As the gun swings with the target, the speed of the movement is increased to overtake the target. Just as the muzzle passes the target, the trigger is pulled. In shotgun shooting the trigger is moved abruptly but in such a way that it does not pull the gun out of its

arc. The gun continues to move in the same path after the shot is fired. The continued movement of the gun during and after firing causes the shot to string out in a horizontal pattern. The follow through and spreading of the shot compensate for: (a) the reaction time of the shooter, (b) the functioning time of the gun, (c) the time required for the shot to reach the target, and (d) the movement of the target while the first three things are happening.

Shooting the bow. There are several steps involved in hitting a target with archery tackle. These steps are similar to those involved in shooting guns. They involve the same position, sighting, breath control, trigger squeeze, and follow through.

The archer stands at a right angle to the target with his feet spread comfortably. The body is not twisted. The toes are on an imaginary line which runs to the target.

When nocking the arrow, the bow is held parallel to the ground with the string toward the body. The bow supports the arrow while it is being nocked. The arrow is nocked with the cock feather pointing up; then the bow is raised. As the bow is raised, the string is brought back with the first three fingers of the shooting hand. This step is called *drawing*. The handle of the bow is gripped firmly but not squeezed. Control is necessary but a heavy grip may cause muscle tremor. The handle is brought up to a point just below eye level. The bow arm is straight but flexed slightly to give the string clearance. The point to which the string is drawn is called the *anchor point*, and is approximately at the upper, back portion of the checkbone. All archers should develop a specific point as the anchor point to maintain consistency in shooting.

Bow sights, which are fairly common on hunting bows, have distances marked on them. Through *sighting in*, the hunter discovers what the location of the sight must be for the arrow to go a certain distance. Two other aiming processes are used in archery. The *point of aim* method relates the tip of the arrow to an object in the foreground. When the tip of the arrow, the archer's eye, and an object at a certain distance are in line, the arrow will fly a known distance. The third method *instinctive shooting*, whereby the archer uses his eye much as a shotgunner does. The bow and arrow follow it. He is also aware of the location of the tip of the arrow. The height adjustment of the bow is done almost reflexively. The shooter shoots with both eyes open, just as the shotgunner does; accurate depth perception is essential to the instinctive shooter and sight from both eyes is required.

Field Safety Practices

There are many rules for gun and archery safety practices. The real problem lies not in learning the rules but in knowing when to apply them. The safest hunters master certain simple manipulatory skills related to loading, unloading, and handling guns. When these actions become almost automatic, the hunter can devote more of his time to the recognition of potentially hazardous situations and the judgments required to overcome them.

There is an old phrase which merits attention. Many people have said, "It's always the unloaded gun which does the harm". This statement may mislead one into thinking that there really is no way to make a gun safe. The saying should suggest instead that people often assume a gun to be unloaded and discover only after an accident happens that it was indeed loaded.

Safety Rules for Guns.

Treat every gun as if it were loaded. There is never any excuse for failing to know whether a gun is loaded or not. Guns should be unloaded when the shooting or hunting is finished, and then checked again before put away. Leaning on the muzzle of an empty gun, or placing the muzzle on a foot and leaning on the butt, is a dangerous practice. Soon the habit becomes established and the gun is used as a prop when it is loaded. Leaning a loaded or unloaded gun against a tree or other insecure support is unwise.

Always point the muzzle in a safe direction. Even the empty gun should not be pointed toward

another person. The safe hunter always knows where his gun is pointing, even when he cannot see the muzzle. The gun must become so much a part of him that it becomes almost a physical extension of his physical being.

Much bad gun handling takes place when several hunters begin loading their guns in preparation for the hunt. Often they stand in a group, talking while loading their guns. Nearly everyone has one or more guns pointed at him. Out of respect for safety, each hunter should face away from the circle while loading his gun. He must then carry it so that it does not point at anyone.

Be sure of your target – and what is beyond. The shooter should know exactly what he is shooting. If hunting, he should see the whole animal and clearly enough to identify it positively. The gun should be used as if it were a camera. Like the nature photographer, the hunter should have a clear, unmistakable picture of the whole animal before he shoots. He should also anticipate where the shot will go if it fails to hit the game or passes completely through it.

Gun carries. There are a number of ways to carry a gun in the field which are safe, yet keep the gun available for use. Standard safety practices include the following: the safety should be on; the finger should be kept outside the trigger guard except when the hunter is ready to shoot; the muzzle should point in a safe direction and be under control. These practices apply whether the hunter is by himself or with a group. Many hunters carry the gun with the barrel over the shoulder and the hand gripping the small of the stock. This is a good carry except when someone else is behind. Carrying the gun cradled in the bend of the elbow with the same hand, or both hands holding it, is also a safe carry — but not when there is another hunter on that side. Many hunters use a carry which causes the gun to point forward and down. The butt is under the arm and the fore end of the gun is supported by the forearm. This, too, is a good carry — but not when the hunter is behind someone else. The hunter must be as aware of the constantly changing movements of other people and their relationships to the muzzle of his gun, as he is aware of the shifting of automobiles in traffic and the need to change course.

Zones of fire. When parties hunt together the areas to be covered should be decided in advance. If the group is hunting birds, for instance, and walking fairly close together across a field, definite assignments as to the zone each party will cover are imperative. It is obvious that all hunters cannot shoot at every bird they see without endangering each other. In a group of three, the center hunter takes the birds going straight away from him. The hunters at the sides take those on their respective side of the line. When parties split up and individuals hunt separately over a wide area, each hunter should be assigned a section and keep to it.

Self-protection. Some hunters do things which endanger their safety. For example, it is considered bad practice to carry deerskins or antlers in such a way that they could be mistaken for a live deer. The safe hunter must avoid actions or appearances which might be misinterpreted by apother hunter.

There has been considerable discussion concerning colors of clothing which would make the hunter so distinguishable that mistakes in identification can be avoided. Many states require that a certain color be worn; of these, some require red and others yellow or florescent orange. Tests have proven that dark reds virtually disappear in poor light conditions. Generally, a bright color, one which would make the hunter stand out from his environment, is recommended. Today, *blaze orange* has more advocates than any other color.

Self-protection involves, among other things, getting over, through, and around obstacles. Good practice dictates that the gun should be unloaded when there is no possiblity of an accurate shot. In practice, since an accurate shot cannot be made while the hunter goes over, under, or through a fence, he should unload. The gun should be placed flat on the ground on the other side of the fence and the hunter should cross at the butt end of the gun. When two hunters want to cross a fence, they unload. One hunter holds both guns while the other hunter crosses

the fence. The guns are handed across and the second hunter crosses. This rule also applies when crossing logs; going through heavy brush; climbing trees, steep banks, and cliffs; or crossing any point where the footing is bad.

Safety rules for archery. While hunting accidents with bows and arrows are comparatively few, the bow hunter must realize that the potential for accidents exists every time the bow is drawn.

Never draw a bow or nock an arrow if someone is in front of you. Accidental release of the broadhead is always a threat. Another person should never be used as a target, nor should a target ever be held by a person. Great care should be taken when examining, showing, or handling broadheads in a group. The only safe place for a broadhead, except when it is about to be shot, is in its storage box or quiver.

Never release an arrow without being able to see its full path to the target. This practice is especially important for bow hunters. Bow hunters often use camouflaged clothing for hunting and are sometimes difficult to see. The target should be seen clearly. Also, an arrow should never be shot straight up in the air.

Never use imperfect equipment. All equipment should be inspected carefully before use. Loose or broken nocks, cracked bow or arrow shafts, loose fletchings or broadheads, or a frayed bowstring may cause injury to the shooter or to another hunter.

The same field safety practices mentioned in the section on guns generally apply to bow hunting. There are, however, a few differences. The arrow may be kept in the shooting position in the field but great care must be taken not to point it at anyone. The nocked arrow may be held tight against the string with the index finger of the bow hand, but there should be no tension on the bowstring. The bow may be drawn quickly but the chance of accidental release is to be avoided. The broadhead should be in the quiver when the hunter cannot make an accurate shot or when he stops to rest or cross a fence.

Automobiles are not the place for loaded firearms, strung bows, or unprotected broadheads. The firearm should be unloaded, the bow unstrung, and the broadhead in its quiver or storage box. Ready-to-shoot hunting equipment should not be taken into camp or placed in automobiles unless the automobiles are used in open country to find game. Where this is true, the hunter should open the action of the gun. An accurate shot cannot be made until the automobile is at a standstill. When the hunter is doing the driving, the gun should be carried in the same opened-action condition, but it should be in a rack which will hold it securely.

Recently, in a certain Rocky Mountain state there were more deaths from heart attacks among hunters in the field than there were from gunshot accidents. Many hunters are once-a-year outdoorsmen. Hunting, in many cases, is a vigorous sport. A physical checkup is needed, especially if the hunt will involve heavy physical exertion or take place at a high altitude. Physical conditioning is also important. Fatigue distorts judgment and opens the door to accidents.

If possible, the hunter should be familiar with the hunting area in advance. Knowing the territory guards against becoming lost and helps the hunter to condition his outdoor vision and to know where any natural hazards exist. Many hunters fail to get game or make mistakes in identification because they are unaccustomed to seeing things under this new light.

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Chapter 3

SKEET AND TRAP

H. Wayne Sheets
National Rifle Association

The shotgun shooting games of skeet and trap have been very popular for many years. In 1974 over 141 million registered competitive clay targets were shot. This figure does not include all those additional targets shot for practice and other informal shooting. It has only been in recent years, with emphasis on outdoor education and lifetime sports, that the value of these games has been recognized by educators. As a result, skeet and trap have shown a rapid growth in popularity in educational institutions.

Although no formal safety records are kept concerning accidents, these games enjoy an outstanding reputation for being accident free. This is the result of training and practicing sound safety procedures. The educator who desires to have a successful skeet and trap program must place safety as the top priority. Safety can be categorized into three major aspects — firearm handling and care, facilities and equipment, and ammunition and reloading. In order to understand these safety areas, an individual must first understand the shotgun games.

The oldest of the two sports is trap shooting, which dates back to the late 1700's. It was originally designed to help the British shotgunner keep his hunting skill in the off-season. It also supplemented the amount of shooting available through hunting. The idea was to release a target out in front of the shooter, thus testing his ability to shoot a "going away target." The first national championship was fired at New Orleans in 1885. Today many individuals participate purely for the competition, with little or no interest in its relation to hunting skills.

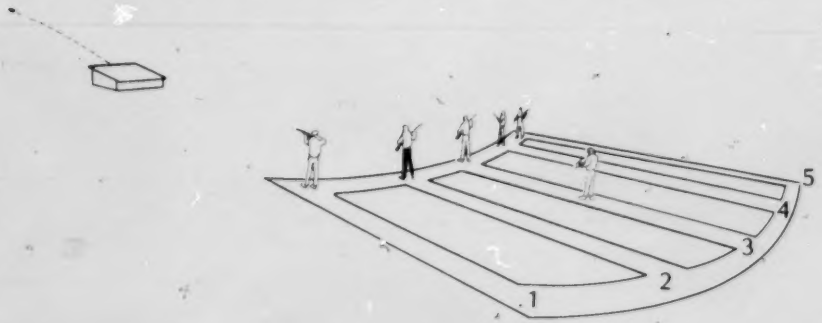

Figure 1: Trap shooting

Skeet shooting originated in the United States for basically the same reasons as trap. In 1910 a group of upland game hunters in Massachusetts began experimenting with clay targets flying

in a variety of different directions. It evolved into what was known as "clock shooting." The shooting field consisted of a circle with a 25-yard radius with 12 shooting stations marked on its circumference. The stations corresponded to the hours of a clock. A target throwing machine (trap) was placed near the 12 o'clock position which threw clay targets toward Station 6. Each shooter shot at two targets from each of the 12 stations, with a last shot being fired from the center of the field. In 1924 the field was reduced to a semicircle with two trap houses, one positioned at three o'clock and the other at nine o'clock. Seven stations were evenly placed around the half circle with an eighth station directly between the two traps. In 1925 the game received national attention. Formal rules were established and it has since spread throughout the world.

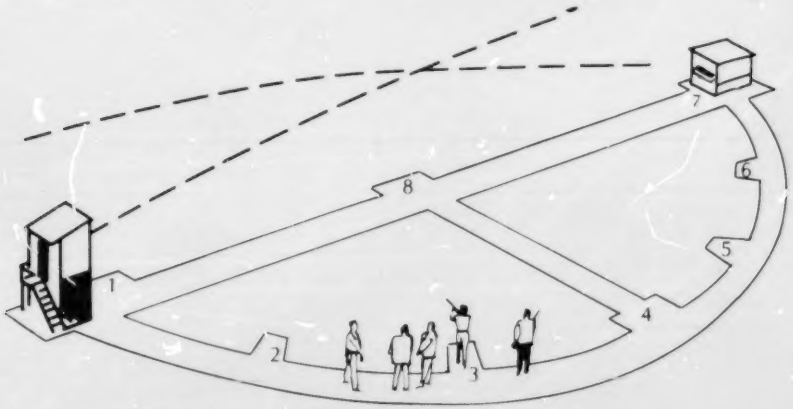

Figure 2: Skeet shooting

Generally referred to as skeet and trap, there are really six different shotgun games. All of these games use the same type of standard clay target. Made of a clay substance, the target measures 4 5/6 inches in diameter by 1⅛ inches in height. It weighs approximately 3.5 ounces.

The shotguns used in these games differ depending on whether skeet or trap is being shot. There are a variety of different gauge and choke shotguns currently available. Gauge is the number used to indicate the inside bore diameter of a shotgun barrel and the size of shotshell ammunition. Choke is the amount of constriction at the end of a barrel, which controls the shot spread (pattern). Modern shotgun gauges, starting with the largest, are 10, 12, 16, 20, 28, and .410. Trap is shot with a 12-gauge shotgun. The chokes are usually full or improved modified. These chokes enable the shot to travel a long distance before spreading. Trap guns normally have 30-inch barrels. Skeet can be shot with a 12, 20, 28 or .410 shotgun. The chokes are usually skeet, cylinder or improved cylinder. This enables the shot to spread quickly at a short distance. Skeet guns normally have a 26-inch barrel.

Skeet and Trap Games

The following are brief descriptions of how each of the six games work.

Domestic (American) Skeet. This game is shot primarily in the United States and Canada. The field layout consists of eight stations, a high trap house (target thrown out at 10 feet above the ground) and a low trap house (target thrown out at 3.5 feet above the ground). Targets are always thrown in the same direction and must fly a minimum of 55 yards from the trap house. A round of skeet consists of shooting at 25 targets. At each station the shooter shoots at a target

from the high house and one from the low house. In addition doubles are shot from Stations 1, 2, 6 and 7. Doubles are targets thrown from both high and low houses at the same time. The sanctioning organization for this sport is the National Skeet Shooting Association (NSSA). Each year a championship is held in the United States.

International Skeet. International Skeet uses the same field layout and is basically the same as domestic, except for three major differences in rules. (1) In International Skeet the butt of the gun stock must touch the shooter's body on or below the belt line (low gun position). It may not be moved from that position to the shoulder until the target appears. The stock may be placed on the shoulder (high gun position) in domestic skeet before calling for the target. (2) In International, after the shooter calls for the target, its release time is unknown. It may appear at any time within three seconds. The target is released immediately on request by the shooter in Domestic Skeet. (3) The target must be thrown a minimum of 71 yards in International, significantly increasing the target speed. All three of these differences greatly increase the competitive difficulty of International over Domestic Skeet. International Skeet, International Clay Pigeon and all other international shooting games shot in the United States are sanctioned by the National Rifle Association (NRA). The NRA receives its authority as the sanctioning sports federation from the International Shooting Union (UIT). UIT is the controlling body for international shooting competition throughout the world. Each year the NRA sponsors the United States International Shotgun Championship. From this championship, the shotgun team that will represent the United States in international competition for that year is selected. International Skeet and Clay Pigeon are the only types of shotgun games recognized for UIT sanctioned competition, such as the Olympic and Pan American Games and World Championships.

Domestic (American) Trap. In Domestic Trap there is one trap house containing one trap machine, which is located 16 yards in front of five shooting stations. The targets are thrown approximately 50 yards to a height of 9 feet. However, their angle can vary laterally anywhere within a 45-degree shooting field. The shooter does not know the angle. Each shooter on a squad fires at five targets from each of the five stations. Depending upon the shooter's ability, trap is shot from 16 to 27 yards behind the trap house.

The Amateur Trapshooting Association (ATA) is the sanctioning organization for domestic trap shooting. This game is the most popular shotgun game in the United States. Each year trapshooters assemble at Vandalia, Ohio to participate in the American Trapshooting Championships, known as the "Grand American."

International Clay Pigeon. The game of International Clay Pigeon is generally the same as American Trap. However, the facility is considerably different, which increases the difficulty of hitting a target. The trap house is much larger and contains 15 trap machines. The machines are spaced approximately 40 inches apart in groups of three in front of each shooting station. Together a group of three machines are adjusted so a target can be thrown laterally anywhere within a 90-degree arc. Elevation is not fixed at a specific level as in American Trap. Traps are adjusted so at 33 feet the target can vary from a minimum elevation of 40 inches above the trap house roof to a maximum of 13 feet. A target must travel a distance of 82 yards. Shooting stations are laid out on a straight line 16.5 yards to the rear of each group of machines. The release of a target is controlled by an electronic selector that keeps the shooter from knowing which of the three traps in front of the shooting station will release the target. There are few international clay pigeon fields in the United States.

UIT Automatic Trap. This game is a modification of International Clay Pigeon and is adaptable to a regulation Domestic Trap field. It is a way of duplicating International Clay Pigeon without the expense of a regulation field. A single trap machine capable of throwing at the angles and elevations of a 15-machine layout is used. It is sometimes referred to as Modified

International Trap. UIT Automatic Trap is recognized by the NRA as a substitute for International Clay Pigeon competition in the United States.

Universal Clay Pigeon. Universal Clay Pigeon is similar to International Clay Pigeon except that only five trap machines are used. The shooter may recive a target from any machine regardless of the shooting station. It is not a common shotgun game.

Firearms Handling and Care

When teaching shooting sports, the first area of safety to be concerned with is firearm handling and care. Although this subject area is normally taught during a specific class period, it is a subject that must be interwoven and taught throughout the entire course. The instructor must establish and maintain it as a constant priority over all other subjects. It is not the type of subject that can be covered once, hoping that the student will sift out and remember the major points. Safe handling and care must be repeated, reviewed and reemphasized at every opportunity.

As is the case with any skills class, most students are more interested in first doing the activity rather than listening to academic fundamentals. This is particularly true concerning the area of safety. In teaching shooting sports, this pitfall must be carefully avoided. Students should know how to handle a shotgun safely before going to a shooting range or using live ammunition. Before this can happen, they must first understand the parts and operation of a firearm and then the safety rules. One of the best ways to achieve this is by "dry run handling exercises" or through role playing. This all requires classroom time. In any case, safe firearm handling ability should be evidenced before going to the range.

After preliminary instruction concerning the knowledge of firearms, it is time to teach the physical skill fundamentals. These skills can be taught safely and easily if classes are kept relatively small. Generally one instructor or assistant for every 12 students is adequate. A good instructor will know, before giving a student live ammunition, whether or not the student understands what is required to hit a moving target. This can be done easily through "dry firing exercises," shooting without live ammunition. The development of sufficient skills before shooting is a major factor in safety control. A student that has not acquired, or does not understand the fundamentals of shooting skills, in many cases will not understand the fundamentals of safe gun handling. This, coupled with an inability to succeed at hitting a moving target, causes frustration and a lack of alertness to safety. This sets into motion the opportunity for a hazardous situation to occur. To repeat, time must be spent preparing the student for that first shot at a target. The instructor should not be rushed into a live firing situation. Initial success greatly enhances learning as well as safety.

The safety of shooters, field personnel, spectators and property is the responsibility of all. The responsibility for seeing that all individuals know and practice safety rests with the instructor. The following is a list of firearm safety rules and instructional comments.

1. *Always treat a firearm as if it were loaded.* This is the "Golden Rule" of Firearm Safety.
2. *The muzzle of a firearm must be pointed in a safe direction at all times.* The muzzle should never be placed on the foot or leaned on as a body support. Wrap a piece of colored tape around the muzzle to emphasize its importance. It is recommended in a class situation that the muzzle always be pointed straight up and not down at the floor or ground. With muzzles down, students are more likely to accidentally point a firearm at another individual. Also, the projectiles from a shotgun that is accidentally discharged into the ground can ricochet and spread.
3. *The firearm action is to be kept open at all times except when ready to fire.* Almost all modern shotguns have some type of action release mechanism. They allow an action to be kept either open or closed. All students must know how these operate. Actions may be loaded and closed only when a shooter is on the station and ready to shoot. "Loading" is

placing a shell in any part of a gun: magazine, action or chamber. When placing a firearm in a rack the action should remain open. The instructor will have to pay particular attention to those who have done considerable hunting. They are used to carrying shotguns with actions closed when in the field.

4. *A shooter must be completely familiar with how a firearm operates and what ammunition it uses.* This must be accomplished before any consideration is given to shooting. It should be pointed out that shotgun ammunition has the gauge size marked on the bottom of the shell. Some shells are color coded according to gauge for safety. Most shotguns will have the specified gauge stamped on the barrel.
5. *Carry only one gauge of ammunition.* An instructor who uses shotguns of different gauges in a class must also carry different gauge ammunition. Smaller gauge ammunition can accidentally be placed in a larger gauge shotgun, thus setting up a very hazardous situation. One gauge only should be used in class. The instructor should keep and dispense all ammunition during the first four of five firing sessions. Students should not be permitted to carry any ammunition at this time. Only after adequate knowledge and skills have been developed should the instructor allow students to carry a supply of ammunition.
6. *Know where your companions are at all times.* This rule is primarily designed for the shooter, but it takes on added significance in an instructional situation. The instructor must be sure the class remains in a safe position in relation to the shooter. In its enthusiasm a class may crowd too close to the shooter and instructor. This is undesirable. It is generally the result of students trying to hear the instructor. In most cases the instructor should speak loud enough for all to hear. This is a problem particularly if the class is wearing hearing protectors. Constant attention should also be given to the movement of field personnel and spectators.
7. *Be sure of your target and what's beyond.* A shooter should always be able to positively identify any target. The area behind it should have an adequate safety zone. On a properly constructed skeet or trap facility, this rule has generally been covered. Where a temporary shooting facility is set up, the instructor must give both these points special consideration.
8. *Never drink alcoholic beverages before or while handling firearms.* Proper consideration should also be given to drugs.
9. *Guns should be cleaned and checked on a regular basis.* From the instructor's point of view, this rule concerns itself with safe functioning more than anything else. A firearm that does not function properly can lead to a number of safety problems. Shotgun barrels should always be checked for obstructions before loading. Students should be instructed to continue to point the muzzle in a safe direction. If a malfunction occurs while shooting, the instructor should find the cause of malfunction and take necessary action. Firearms should be cleaned after use and checked annually by a competent gunsmith.
10. *Only one shell should be placed in the gun at a time, except when shooting skeet or trap doubles and International Trap.*
11. *If a delay occurs while the shooter has a loaded gun, the action must be opened and all shells removed.* This includes a delay caused by the need for additional instruction. If the instructor feels it is necessary to talk to the student, other than for a quick correctional comment, the firearm should be unloaded. Any comment may cause a student to inadvertently turn the muzzle toward the instructor or class. The instructor must be aware of this and be in a position to correct the problem quickly.
12. *Dry firing (shooting with no ammunition), shouldering or dry swinging the firearm may only be practiced on the shooting range or in a designated safe area.* When shooting on a squad, none of these exercises are to be done while other squad members are shooting.
13. *A firearm should be placed in an appropriate gun rack or safe area when not in use.* On a windy day firearms can be blown out of a rack.

14. *Safety glasses and ear protectors must be worn.* Commercial hearing protectors can be purchased. Cotton or erasers that slip on the end of pencils may also be used as an interim measure.
15. *A billed cap should be worn to protect an individual from being struck by broken pieces of a moving target.*
16. *Shells should be ejected in a safe direction.* Shells ejected from a shotgun can strike the shooter or others and cause injury.
17. *If a shotgun shell fails to fire, wait about 5 seconds before opening the action.* It seldom occurs, but sometimes a shell may have a slow burning primer. This is referred to as a "hang fire."

Facilities and Equipment

Most people will turn their attention to firearm safety when thinking of skeet or trap shooting, overlooking facility and equipment safety. There are many variations in shooting facilities used by educational institutions. Some are simple and inexpensive while others are costly and complex. All have basic safety rules that apply. Some will have additional safety considerations unique to the particular facility.

Many educational institutions are fortunate enough to have a community club facility available to them. If use of such a facility is available, it is best to put in writing any agreement or restrictions for its use. In most cases, gun clubs are made up of private memberships. They generally do not mind making their facilities available, during off hours, for organized education programs. However, this does not mean that they wish to open their club program or facility to the general public. Arrangements for the use of such a facility includes cost, use times, responsibility for facility when in use, insurance agreement and guidelines for safe supervision. The instructor directly responsible for the program should be completely familiar with all safety procedures that would come into play before, during or after a class, recreational or formal competitive activity.

If a community facility is not available it may be necessary to select a shooting site. Many points remain the same in site selection regardless of whether a permament or temporary facility is being planned. A shot fall zone of 300 yards should be allowed in front of all shooting points. Adequate room must be left behind the firing points for the class to assemble. Boundaries should be clearly marked to guard against people wandering into the firing zone. It is best to lay out a field toward the northeast. This will, in most cases, prevent the shooter from shooting directly toward the sun. Select a shooting area with a sky background when possible. Backgrounds with trees, hillsides and other objects in the distance increases the difficulty of hitting the target, particularly for beginners. Be sure to place the site in an area where the noise will not disturb others. On the other hand, do not place it where accessibility would be difficult for students. Local ordinances and zoning regulations should be checked. Water, parking and a first aid kit should be available. It is desirable to have some type of shade or building.

In mentioning skeet or trap, many individuals think of a regulation skeet or trap facility. However, the basic shotgun skills necessary for skeet and trap shooting can easily be taught using an inexpensive hand trap (hand thrower) or a single spring-loaded (manual) trap. A hand thrower is simply a target-throwing device that is held in the hand. It is moved in much the same manner as a tennis racket. It takes practice to use a hand trap safely. There are several safety points to remember. Care should be taken when cocking or handling a hand trap to avoid accidental release of the target. Most hand traps are designed to be used in the right hand only. Class members should stand to the left rear of the thrower. The shooter must stand to the left and slightly ahead of the thrower. Both the thrower's and shooter's stations should be marked on the ground. A manual trap is easily portable like the hand trap. It is usually placed on the ground and has a powerful spring operated throwing mechanism. It also has a "blade" on which the

targets are placed for throwing. The same safety precautions should be used as with a hand trap. Particular attention must be given to keeping any part of the body away from the throwing blade.

Some regulation skeet or trap ranges use manual traps, but in most cases electric traps are used. These are operated from behind the shooting stations by use of a portable electric release control. This control is connected to the trap by an electric cord. The trap is cocked automatically when the machine is turned on. Most electric traps have a magazine which holds a reserve supply of targets. If such a self-loading trap is used, a target from the magazine is automatically placed on the throwing blade. Upon release of the target, the trap automatically recocks and reloads.

When using an electric single-load trap, the loading process is done by hand. The machine automatically cocks itself, but does not have a magazine. Each target must be placed on the throwing blade by hand. The safest position for loading is from the left rear of the trap. Loading is done with the left hand. This keeps the body away from the throwing blade.

When some machines are turned off, the trap remains cocked and loaded. There is a release lever that can be pulled to place the throwing blade in a safe uncocked position. However, on some electric traps the blade is automatically released when the machine's power switch is turned off. Electric traps, like most equipment, are komplex and require the utmost in attention to safety by the operator.

The following is a list of primary facility and equipment safety rules which should be followed.

1. Only those completely familiar with the safe operation of trap machines or throwers should operate or handle them.
2. Avoid stepping in front of a cocked trap or the immediate area from which the target emerges.
3. Skeet houses should have a safety shield around the target release opening.
4. When placing a target on a trap manually, it should be done in such a way that if the trap should be released accidentally, the throwing arm will not strike any part of the body.
5. Before making adjustments or refilling magazines, traps must be uncocked and the electricity turned off.
6. Electrical trap release cords must be safely anchored against extreme pulls. There must be no exposed or poorly insulated wires.
7. If self-loading electric traps are used, testing and filling of the magazines should be completed before bringing shooters to the field. This will cut down on the possibility that inexperienced individuals may try to help.
8. The shooting ranges and trap machines should be kept free of debris, broken targets and empty shells. A dirty trap machine will often jam, again prompting an inexperienced individual to get involved.
9. In cold weather, an electric trap machine should be turned on 15 or 20 minutes before shooting time. This will give time for the oil to warm-up so the machine will function properly.
10. Traps should be checked on a regular basis to be sure they are functionally safe.
11. All electrical equipment must be grounded.
12. A circuit breaker switch should be located at the back of each field.
13. Firing zones may be entered only after all shooting has ceased and others know of your movement. This applies to shooting on adjacent fields as well.
14. Safety rules should be posted in appropriate buildings and on all ranges.
15. Safety areas should be clearly marked for spectators and waiting shooters.
16. All participants and spectators should be familiar with safety flags, lights, or other signals used by field personnel in zones of fire which indicate cease firing.

17. Empty shells should be left on the ground while others are shooting.
18. Unexpected intereference while a group is shooting can create safety problems for all. The following are a few common interferences; there are others. In any case safety takes priority — *stop shooting immediately and unload.*
    a. Trap boy throwing empty target boxes from a trap house.
    b. Continual broken or irregular targets being thrown from a trap.
    c. Opening a trap or skeet house door.
    d. Trap boys loading magazines or running in or out of trap houses.
    e. Persons moving on the shooting range or in the line of a shooter's vision.
    f. Dogs or other animals on the shooting range or in the line of fire.
    g. Wind-blown object in the air.
19. Adequate gun racks should be available in appropriate areas to store guns safely when not in use.
20. Individuals assigned to assist or work must be properly trained ahead of time and must understand all safety rules.

Ammunition and Reloading

Much of the success in today's shooting sports education programs can be attributed to the economy, fun and ease of reloading shotgun ammunition. An educational institution that wishes to have a shotgun program will usually find it necessary to have some type of reloading program. The primary reason is to cut down on the cost of ammunition. In addition, it is an opportunity to teach students the basic knowledge and skills of reloading.

In order to have a reloading program an adequate facility must be located where reloading equipment may be set up and materials safely stored. Federal, state and local laws and fire regulations, which may affect the storage of powder, should be checked.

The careful evaluation and selection of reloading equipment is extremely important. Equipment should be safety oriented, dependable, easily serviced and rugged. Safety is of the utmost importance. Reloaders which are designed for high speed production often lead to errors in an instructional situation. They are designed for use by individuals who know specifically how to run them on a regular basis. They can get out of adjustment easily and are difficult to keep in peak operating condition when used by a group of people. Some of the smaller inexpensive reloaders are more appropriate for instructional use.

There are both advantages and disadvantages to purchasing just one model of reloader, as opposed to a variety of reloaders. Purchasing the same model for all the students to use cuts down considerably on the chances for reloading errors by limiting the variables. With one model, maintenance, adjustments and availability of parts are a simpler matter. On the other hand, a variety of models gives the student an opportunity to learn more about the different types of reloaders on the market and how they work. This adds to the educational value of the experience.

There is a large variety of ammunition component products on the market for reloading. These components are shells, primers, powder, wads and shot. In all instances, the ammunition manufacturer's specifications should be followed. It is a good idea to standardize components used. This cuts down the chance for error.

Having different gauge reloaders, shells and wads in the same area can create a safety problem. It is possible to use a .20-gauge shell case in a .28-gauge reloader and vice versa. It may split, but sometimes it will stretch and not be noticeable to the novice or expert. Reloaders should be clearly marked as to their gauge and loading capacities. Contents in powder and shot containers should also be clearly marked. Shells, powder and wads of a different gauge which are not in use should be placed out of reach, so they will not become mixed with others.

Reloaders should be checked regularly to make sure pressure gauges, alignments and die

settings are correct for the particular type of reloading desired. Adjustable resizing die rings should be checked daily before use since they may become loose. Most reloaders have a preset charging bar for a specific charge of powder and weight of shot. When using preset charging bars, instructors will have virtually no trouble with varying powder charges and shot weights. However, adjustable charging bars on reloaders must be constantly checked for accuracy. They have an adjustable lock nut which may work loose. It should be remembered that a charging bar which may be all right for one type of powder may not be correct to use with another type. Powder charges vary with different brands of powder. Check the manufacturer's recommendations. Maintenance work on reloaders should be done by experienced people only.

A reloading facility should be supervised by the instructor and/or carefully selected and trained individuals. There will be some students who feel they know all about reloading. Instructors must be very positive in handling this problem and must assume that *everybody is a beginner*. The experienced reloader will be easy to recognize.

After explaining the mechanics of reloading, the students should see a demonstration of how it is done. They should then try it under supervision. The instructor must be sure that they understand all points, and be alert for those students who do not follow the proper loading sequence.

Instructors should remember that, for many students, it will be their first encounter with reloading. Although simple to teach, it is easy to miss important points that are essential to safe reloading. Each part of the reloading sequence must be taught carefully. Patience is of the essence in teaching reloading. If properly taught, the student will learn quickly and safely, how to reload at a fast enough pace to suit himself and the instructor.

With good instruction, a well-planned reloading program can be run safely. To insure against the development of poor habits by students, such as reloading short cuts, continuous supervision is essential. Students should be discouraged from talking while reloading. This is probably the major cause of mistakes. Radios and the like should not be playing while reloading. It is a distraction and increases the chances for error. All students should reload their own shells.

The following are additional points which may cause reloading safety problems to occur.

1. Inattention.
2. Smoking or the use of an open flame in the reloading area.
3. Use of intoxicants before or during reloading.
4. Devising "short cuts" or "speed-up systems" for shell reloading.
5. Spillage of powder or live primers on the floor.
6. Unlabeled or improperly labeled containers.
7. Forcing reloaders when something appears to be wrong.
8. Deactivating of safety devices provided on reloading tools.
9. Use of wrong size charging bars.
10. Use of untested reloading data.
11. Misreading of charge data.
12. Use of wrong or unidentified components.
13. Confusion in shell identity.
14. Reloading shells weakened by wetness, corrosion, or having faults such as body splits, perforations, or incipient cracks in the head area.
15. Wrong weight of shot or powder charge.
16. Inadvertent mixing of different types of powders.
17. Failure to check the weight of powder and shot thrown by reloader.
18. Improper use of weight scale.

Another major safety consideration in reloading is the storage of powder. If stored properly, today's smokeless powders are generally free of deterioration. The easiest way to check for powder deterioration is by opening the container and smelling its contents. Deteriorating

powder has an irritating acidic odor. Powder exposed or near extreme heat produces acidity, thus deterioration. The chemical reaction causes heat to be generated, which can cause a spontaneous combustion.

Powder from old ammunition should not be saved or blended with new powder. Old powder stocks should not be accumulated. Deteriorated smokeless powder should be disposed of by burning in an open isolated location. Unconfined smokeless powder does not explode, it burns. The powder should be stacked in small piles not more than one inch high with no more than a pound of powder to a pile. A slow burning "ignition train" should be used to ignite the powder. Be sure to stay a safe distance away after lighting the ignition train.

The following are safety rules for the storage of gun powder.

1. Store in a cool dry place.
2. Store away from direct exposure to the sun's rays.
3. Store away from mechanical or electrical equipment.
4. Store away from electrical outlets or circuits which may be improper, defective or overloaded.
5. Store away from flammable gases, solvents or highly conbustible materials.
6. Storage cabinets should be ventilated and separated from each other.
7. Cabinets should have weak seams and joints to provide for easy self-venting.
8. No smoking signs should be posted.
9. Storage area should be clean and neat.
10. Department of Transportation approved containers should be used for storage.

Once ammunition has been loaded, it should be stored in an area separate from the firearms, preferably under lock. Live ammunition and firearms should never be brought into the classroom together. All ammunition should be kept in properly labeled containers.

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Consultants

Michael Tipa, National Rifle Association, Washington, D.C.
Fred Schuette, American Alliance for Health, Physical Education and Recreation — Outdoor Education Project, Michigan State University, East Lansing, Michigan.

Chapter 4

HIKING AND MOUNTAINEERING

By
Gordon E. Howard
Clemson University

This chapter is directed toward persons who serve as hiking/mountaineering trip leaders, particularly those who have leadership suddenly thrust upon them as a task pursuant to their responsibilities within an organization. Many would-be leaders start out as trip participants or assistant leaders. Leaders would do well to study these considerations to determine whether or not their behavior could be hazardous to trip members. In order for a trip leader to conduct a safe, enjoyable and rewarding trip, he must be aware of the participants' capabilities and expectations and must also possess the appropriate outdoor skills. Hiking can be a complex skill, particularly as it progresses toward mountaineering. No one article can teach each leader all there is to know about the subject. Serious leaders should read many authors' views and experiences (see references) as well as gain practical experience under a variety of conditions.

Generally, hiking refers to extended walks primarily in rural areas. Hiking most frequently takes place on non-paved surfaces such as paths, on abandoned roadways or across country (no trail or maintained path or road). The comments herein are directed toward hikes in areas where assistance, other than from group members, is not close at hand. Certainly some of the safety problems herein mentioned are present on a walk around the block. But the presence of readily available shelter and medical assistance places these hazards in a context within which the average person is able to effectively deal with them.

Hiking, as an activity, includes a wide range of activities. These activities may be grouped into three categories:

Hiking is walking in a rural area. Often the hike is to a destination, but it may be on a loop trail with no one point being the objective of the hike.

Backpacking is a means of extending a hike so that greater distances may be covered or more time may be spent in the country. It is the coupling of camping and hiking with the camping equipment being carried by the hiker.

Mountaineering is the extreme in hiking. Most frequently it includes backpacking simply because the objectives are more than a day's walk from a road access. The distinguishing characteristic of mountaineering is its reliance on high angle rock and ice climbing techniques in order to attain the hike's objective.

Responsibilities of the Trip Leader

The trip leader has a multitude of responsibilities (9) which he must fulfill in order to insure the success of the hike and the safety of the group members. The areas of concern (discussed in detail later) include: proper planning; scouting the area of the hike; being physically fit; interviewing prospective trip members to determine their fitness and level of skill; specifying necessary equipment and checking to see that each member has the proper equipment in good

condition; obtaining proper medical supplies; checking immediate and long term weather forecasts for the trip area; and leaving a trip plan and schedule with a responsible person.

The trip leader should possess all of the skills necessary to safely accomplish the trip's objectives. However, on hikes into remote areas, particularly where it is unlikely that other parties will be met, an assistant trip leader should be recruited. Trip leaders are not immune to injury. In fact they must often take more risks than other party members when conditions call for rigging safety lines. Theoretically, the leader's experience and skills offset the added risks, but that is not always the case. The assistant leader should possess abilities and experience similar to those of the trip leader. The more difficult and technical the trip, the closer the assistant should approximate the leader in knowledge, skill and experience. It is the leader's responsibility to select a competent assistant.

Responsibilities of the Group Member

While the non-leader looks to the leader for guidance and safety, he cannot place all of the responsibility for his well being on the leader. Actually, the bulk of the responsibility for the participant's safety lies on his own shoulders. He must judge the adequacy of his skills and fitness. If he lets his desire (or ego) place him on a trip for which he is poorly prepared, he is as much at fault for signing up as the leader is for accepting him on the trip. Additionally, the individual must consider the effects his shortcomings will have on the safety of the other participants. A weak hiker could cause delays that force the group to spend an unplanned night out.

The group member should inform himself about the trip; its plan, schedule, and location; the equipment required; and the skills necessary. One area that is often overlooked is the checking on the leader's abilities and reputation. Most people reason that a leader is a qualified hiker or mountaineer. Yet, leaders become leaders through a variety of avenues. Even on commercially run trips the leader may be the leader because he is the only staff member available at the time — and the show must go on. Non-commercial trips generally have a self-appointed leader. This person may possess excellent skills. Frequently, however, the person wants to take a trip someplace and needs some other people along "just in case". The trip may be beyond his capacity, or his only concern may be reaching the objective regardless of the hardships imposed on the group. The group member is solely responsible for placing himself on a trip led by a person of questionable skill and character (6).

Finally the hiker should beware of trips where the leader offers assurances that he, personally, possesses the skills "to get you through". The leader may in fact possess those skills. But, aside from being egotistical (which is a dangerous quality in a leader) it assumes that the leader will survive all hazards. From a conservative standpoint the leader is saying: "If I don't get through, you (the participant) don't get through".[a]

Personal Preparation: Physical Parameters

Hiking can vary in its demands from a mild walk to a rigorous mountaineering expedition. The safe completion of any hike, regardless of its difficulty, depends in part on the hiker's ability to summon forth the energy necessary to finish the hike. Studies of walking indicate that energy expenditure is not affected by sex, age, or race. Body weight is the prime determinant of energy cost differences between individuals walking at the same speed (8:355). Personal physical fitness, then, is a requisite to safe hiking. Unfortunately for inexperienced hikers, there is no standard rating scale for the difficulty of hikes. The novice is left to his own judgment as to the physical conditioning necessary for safely completing a specific hike.

[a] This is a conservative statement because it acknowledges the ultimate risks involved in the situation. It recognizes no miracles.

If the prospective hiker has been inactive he should have a physical exam before undertaking a conditioning program (in any event individuals should undergo an annual physical exam). The physician should be informed of the intentions of the individual to hike in wilderness areas. Upon satisfactory completion of the exam, the individual is free to start any one of the standard fitness programs or he can consult a physical educator for a custom designed program. Running is excellent preparation for hiking, but arm and shoulder strength should not be ignored. Any individual who can jog three miles without rest or undue fatigue will be able to participate in most one day hikes that are of moderate difficulty (See section on climate for extenuating circumstances). Participation in several hikes of varying difficulty will give the participant sufficient background to judge his ability to complete future hikes.

Even persons who are in good physical condition can contract infections or suffer minor injuries such as blisters or sprains. These persons should have the common sense to stay home. However, the leader should inquire about these conditions. Hikers who are debilitated or whose performance is impaired present a hazard to the remainder of the group. The trip leader should refuse to permit such individuals on the hike, if in his judgment, they will impede the progress of the group.

Certain hikes will require acclimatization to heat and/or high altitude. Though these topics will be discussed in detail later, they are physical adjustments which need to be considered as part of an overall physical conditioning program.

Personal Preparation: Psychological Factors

The need for physical conditioning as a requisite for enjoyable hiking is a generally accepted concept. Yet little attention has been given to psychological conditioning. Even hikes of low to moderate difficulty often entail considerable emotional involvement, particularly in sudden severe weather conditions or in emergency situations.

Tolerance of effort. The most constant psychological stressor of hiking is the physical exertion itself. Most novice hikers are poorly prepared to deal with the pain associated with local muscular fatigue. They require frequent rest stops which produce diminishing relief from fatigue as the hike progresses. Experienced hikers learn to tolerate the pain and to combat the fatigue by driving themselves onward while thinking about anything but the fatigue. Many enjoy the feeling of physical fatigue because it is an indication that they have accomplished something that day. If the novice persists at the activity he will "learn to love it".

This psychological adjustment is necessary if the hiker is to be able to complete hikes without slowing the group due to his perceived need for rest. Tolerance to fatigue can be developed through the physical conditioning program if long, continuous jogging is included as part of that program. A general rule of hiking is to walk for 20 minutes, then rest 5 minutes. Continuous jogging on relatively flat, smooth terrain, for 20 minutes will simulate the fatigue encountered on hikes. Obviously, the better the hiker's physical condition the less fatigue he will suffer on a given trip.

One note of caution; local fatigue can be tolerated and reduced by slowing the pace or taking a short rest. It should not be confused with total exhaustion in which the individual begins to lose control of his coordination. This latter condition calls for immediate attention. Periodically, the leader should check all participants for signs of exhaustion. He should learn to recognize the difference between a person who has a low exercise stress tolerance and one who is near total physical exhaustion.

Emotional stability. An often overlooked area of hiking safety is that of the emotional stability of the trip participants. In recent history man has chosen to live in environments of his own making. As a result, most hikers, and particularly novice hikers, are continually under emotional stress resulting from the problems presented by the natural environment. Frequently

this emotional stress is augmented by the necessities of interacting with the other trip participants, many of which may be strangers or casual acquaintances.

The safety of the trip is jeopardized when this stress gets to the point that it is intolerable to a participant. When that point is reached the participant may refuse to continue or, worse, set out for home on his own. Children, when under severe stress from interpersonal interactions (e.g. they are being picked on) frequently run off into the woods just to get away. No thought is given to safety, supplies or returning to the group. This results in a lost hiker who is neither physically nor emotionally prepared to cope with the elements.

Whenever possible the trip leader should screen out those persons who may not be able to cope with the stresses of the trip. This may be accomplished through interviews with prospective participants and with leaders who have had participants on other trips. Naturally, the requirements will vary in accordance with the difficulty and duration of the trip; long and difficult trips require good emotional stability and the ability to live closely with others.

On the trip the leader should be alert for interpersonal disharmonies. Every effort should be made to abate such problems before they can become severe. A good trip plan, including a schedule of duties and responsibilities, will do much to prevent such discord. Also, the reduction of environmental stress, whenever possible, will aid in maintaining the emotional stability of the participants.

Group participants should know the emotional stability of their leader. Those *leaders* who are *slave drivers*, who cannot make effective decisions — particularly under stress, or who do not have the respect of the participants should be avoided.

Phobias. Most people probably picture hiking as taking place along a trail with large amounts of land on either side of the trail. Trails along narrow ledges are thought to be part of mountaineering. These perceptions do not hold true. Many hikes require the individual to sustain exposure to drop-offs on one or both sides of the trail. Such conditions exist in the eastern United States as well as in the west. Trip leaders should inform prospective participants of any exposure to conditions that would produce hysteria in someone with acrophobia, agoraphobia (open places), claustrophobia, hydrophobia, and viperphobia (snakes). In confined areas, such as canyons or exposed ledges, a person who develops hysterical paralysis can divide a group, separate the trip leader and his assistants, and present high risks to those attempting to rescue that person.

Knowledge

The safety conscious trip leader will acquire a considerable knowledge of the outdoors and the skills necessary for safe participation in hiking and mountaineering. This knowledge can be obtained through: (a) reading on various related topics, (b) participation in trips of varying difficulty in a variety of climates and terrains, and, (c) by attending seminars and training institutes. The acquisition of this knowledge will take a considerable period of time. However, there are many trips that can be taken where minimal skills are necessary.

The trip leader should be knowledgeable in the following:

Area. Prior to beginning a trip the leader should gain as much knowledge about the area as possible. He should be concerned with weather, altitude, quality, quantity and location of drinking water, precipitous exposures, confined places, unusual animal or insect hazards, and alternative routes. These data may be obtained from guide books, topographic maps, managing agencies and previous trips. If a novice group is to be taken into an area unknown to the leader, the leader should make every attempt to make a scouting trip with a few experienced outdoorsmen prior to the novice trip.

Equipment. When the leader has analyzed the data about the area, he is ready to specify the equipment required for safe completion of the trip. There are three categories of equipment:

personal equipment (shoes, packs, sleeping bags, etc.); group equipment (stoves, cooking equipment, etc); and safety equipment (ropes, first aid kit, etc.); The trip leader should be well versed in the proper operation and use of all group equipment to be used on the trip (See subsequent section dealing with equipment).

Skills. Each trip requires a variety of skills. The trip leader should possess those skills and should insure that the participants possess those skills that are essential for the trip. These skills might range from walking on uneven ground to technical snow climbing techniques.

First aid. In theory, every trip should have at least two persons trained in first aid. If one trained person is severely injured the other can administer first aid. In practice many trip leaders do not have first aid training and they make no effort to determine the training of the participants. Many easy hikes require only knowledge of the proper treatment of blisters, sprains and insect bites. But as the difficulty of the hike increases and/or the trip enters remote areas the need for trained medical personnel increases. Some participants on backpacking trips should be trained to deal with the problems listed in the sections, Specific Conditions and Common Problems included in this chapter. Anyone who is planning to lead trips on a regular basis or as part of a job should take the instruction necessary to become an emergency medical technician.

Leadership. The success of any hike depends on the leadership. There are many leadership techniques. The leader should develop a style that suits his abilities and personality and study the techniques used by other successful leaders. The objective of leadership is to direct the course of the trip in such a manner that the objectives of the trip are fulfilled safely. This not only implies that the leader must be able to use his knowledge of the area, equipment and skills, but he must also be able to use the talents of the trip participants. If his leadership is questionable he will not be permitted to use his knowledge nor will he be able to direct the group in emergency situations.

Equipment

In the past 15 years there has been a tremendous increase in the types and complexities of hiking and mountaineering equipment (5, 7). Many of the improvements have made the equipment more durable and dependable, and hence, potentially safer. Hazards arise when equipment is not suitable for the trip conditions, is not suitable for the individual or is in poor working condition.

The trip. When the trip leader has gathered the information on the area in which the trip will take place he is then able to specify the necessary equipment. For example, a sleeping bag that is suitable for trips at lower elevations (1500 m.) in the summer may not be suitable for higher elevations (3000 m.) in the summer, much less in the winter. Similar comparisons for clothing and shelter can be made. Obviously inadequate protection from the weather can seriously jeopardize a trip.

The individual. Equipment must be selected with the individual in mind as well as the conditions of a trip. Body size and physical work capacity are important considerations. No one should carry more weight than is necessary whether it is in a backpack or in boots that exceed the requirements for the trip.

Poorly fitted equipment can produce a multitude of safety hazards. Depending on the nature of the fit, these hazards could include: too rapid heat loss, inadequate heat loss, excessive fatigue, muscle cramps, strains, sprains, blisters and a host of other problems. Personal equipment should be purchased after careful study and fitting. It should be used only for the conditions and purposes for which it was designed.

Among novices and some experienced hikers there is a tendency to rely on gadgets instead of skills in coping with the environment. To be sure some equipment innovations are highly effective and contribute to the enjoyment and safety of a trip. Too often, however, the novice

loads up with gadgets to the extent that he can barely walk under the load. When a gadget fails, he is at a loss for alternatives. In the out-of-doors one's faith should be in one's skills, not in technology.

Equipment maintenance. Even equipment that is beneficial to hiking and mountaineering is useless or dangerous if poorly maintained or improperly used. Torn tents, sleeping bags and clothing will not withstand the rigors of environmental stress. Stoves that do not work make fixing a hot meal above the tree line very difficult. All equipment should be checked for needed repairs and repaired after each trip. All equipment should be checked for proper operation before embarking on a trip.

Nutrition

Hiking and mountaineering can be physically demanding activites. Since safe hiking depends on the proper functioning of the body, proper nutrition must be maintained.

Quantity. The caloric cost of hiking and mountaineering is related to the strenuousness of the activity, body weight, ambient temperature, wind, precipitation, the individual's skill and numerous other factors. However, it is generally recommended that, for hikes of at least moderate difficulty, the daily diet include a minimum of 4000 kilocalories (kcal.) (5:443-445; 8:355). Strenuous hikes and winter trips may require energy expenditures in excess of 7000 kcal./day. That additional energy requirement is necessitated by the low ambient temperatures and the increased difficulty of walking on snow. Walking on loose level snow uses about 8 times the energy required to walk on level pavement [Calculated using data from Bogert, (1:40); Ferber (5:443)].

Adequate food should be taken on any trip to meet the planned needs and any demands brought about by emergenices, weather changes and delayed returns. The caloric content of foods is not the only factor. The quality of food is also important.

Quality. Most hikers have been aware of the need to increase caloric consumption for strenuous trips. Frequently this increased consumption was gained by increasing the quantity of well-balanced meals. Recent information indicates that the types of food eaten need to be adjusted for the difficulty of the exercise and the altitude. Strenuous exercise and high altitude tend to produce acidosis. This acidosis contributes to fatigue and muscle cramps. Recent quasi-scientific reports indicate that acidosis may play a role in acute mountain sickness.

While further research in this area is needed (and appears to be forthcoming) some control of acidosis can be maintained if protein intake is held to a minimum (50-80 grams/day) distributed throughout the day (1:83; 5:445-446; 8:356). The acid wastes of protein metabolism must be removed from the body by the kidneys. This process takes several hours. Hence, a high protein meal prior to exercise can contribute to acidosis, fatigue and cramps. It would seem reasonable to schedule high protein meals for the evening when vigorous exercise will not follow. It should be noted that, except for periods of physical conditioning, the body's need for protein is not affected by exercise (1:94; 5:445).

Additionally, acidosis can be regulated through the consumption of base-forming foods such as fruit, vegetables, nuts, and milk; and by avoiding large quantities of meat, eggs, cereals (including bread) and corn particularly before exercise. Mineral buffers that contain sodium, potassium, calcium or magnesium may be used when acidosis is a problem (1:230). Commercial tablets for counteracting stomach hyperacidity contain these elements in a convenient to use form.

Since the wastes of carbohydrates and fat metabolism are excreted primarily through the lungs, these waste products are rapidly eliminated and do not significantly contribute to acidosis (1:333; 8:356). The majority of the energy required for hiking should come from carbohydrates. Fats, while higher in calories per unit weight than carbohydrates, slow the

digestive process and require more oxygen to metabolize, a disadvantage at the higher elevations.

Food spoilage. With modern packaging and food processing, problems presented by food spoilage can be easily overcome. Most chain grocery stores carry freeze dried foods that are suitable for weekend expeditions. Of course, complete meals can be purchased from hiking specialty shops. While these foods do not spoil readily, they do have a limited "shelf-life" of not more than 3 to 5 years. Some products may have considerably shorter shelf-lives. To be on the safe side these food stuffs should be purchased from suppliers who have a good turnover rate, shortly before the trip.

Other problems of food spoilage occur when fresh foods are used or packaged products are repackaged prior to their use. Particularly in the warmer seasons and in warm climates, care should be given to fresh foods taken on trips, even day hikes. Meat, poultry and egg products can spoil in a matter of hours on a hot day. Spoilage can be reduced if the food is frozen prior to departure and then kept insulated in the center of a pack with clothing or other nonconductive materials. (Note: If the above procedure is followed, make certain that the food is well sealed. Many animals, like bears and skunks, will tear open a pack that smells of food).

Many hikers prefer to make up their own packaged meals. Care should be taken to avoid contamination of these foods during the packaging process. Also, the packages should be well sealed. Heat sealing devices are available through several chain department stores.

Water purification. The quantity of water required by the body for proper functioning varies with the level of exercise, humidity and temperature. Often this quantity exceeds the amount most hikers are willing to carry from home. As a result, water found along the trail serves as a source of much of the hiker's water. There are few water sources that can be assumed to be free of bacterial agents that might be detrimental to the consumer. However, there are many sources that have a reasonable probability of being safe for consumption without treatment. For many hikers, one of the pleasures of hiking is being able to drink water unadulterated by chlorine, flourides and softeners.

The pleasures of drinking water in the wild can be severely negated if polluted water is consumed. The trip leader should know the quality of the water in the area to be traversed. His equipment list should include the necessary chemicals and equipment to provide safe water for the group. Some form of disinfectant should be carried as an emergency aid at all times. The number of thoughtless and ignorant hikers is growing. The result is that many water sources become temporarily polluted even in the remote areas. The importance of the leader fully investigating water quality in the area cannot be over emphasized. Note: As altitude increases, water boils at a lower temperature. As a result, adequate water purification may not be possible by boiling alone.

Hikers in areas where water is generally not safe to drink, or those going backpacking on long trips in remote areas, should consult a physician to get medication that will permit the hiker to hike out of the wilderness should he contract an illness associated with polluted water.

Common Problems

There are an innumerable variety of hazards that the hiker faces. In fact, he faces all or most of the dangers faced by any person. Some of the most common problems are listed in this section with a brief description of any factors that are unique to hiking and mountaineering. The section is not meant to be a substitute for proper first aid training. Rather, it should serve as a guide, indicating problem areas where the trip leader should undertake further study.

Blisters. Blisters, probably the most common problem among hikers, are injuries that can be avoided almost entirely. While blisters can occur from contact with hot objects, most hikers acquire blisters on their feet. Foot blisters are caused by improperly fitted and broken-in shoes,

wrinkled or darned socks, excessive accumulation of moisture (usually perspiration) in the socks and poor walking techniques. Blisters can be prevented by using only shoes that fit properly [See Manning (7), Chapter 8]. Properly fitted boots (shoes) will need to be broken-in, gradually, prior to any hike. If backpacking is planned the broken-in boot should be further broken-in under a load equivalent to the load to be backpacked. Additionally, blisters can be prevented by making sure that socks are smooth and conform to the foot before and after putting on the boots. Replacing damp, sweaty socks with a dry set reduces the chance of getting blisters. Hiking boots are made for heel to toe walking. Foot positions other than heel to toe will cause excessive friction and aid in the formation of blisters. Areas with blisters or prone to blister may be protected with flannel-backed adhesive tape or foam-backed adhesive pads. These are available in the foot care section of most pharmacies.

Bites. Throughout most of the year, insects, spiders, bees and snakes present some hazard to hikers. To most hikers, insects, spiders and bees inflict only minor discomforts. Bites can be prevented, to some extent, through the use of commercial insect repellants. They can be reduced by avoiding marshes, watching for signs of bee activity and maintaining clean campsites. Some people are extremely allergic to insect venom. Trip leaders should interview each individual so that they are aware of any person on the trip that has reaction problems. Additionally, the leader should check to make certain that the individual has brought his medication and that someone on the trip, other than the potential victim, knows the proper procedure for administering the medication.

Snake bites, while played up as a major outdoor hazard, actually account for fewer deaths annually than do insect bites. While poisonous snake bites are serious problems, some authors claim that the victim is more apt to go into shock from the thought of having been bitten than to suffer severe complications from the bite. Bites can be prevented by careful observation of one's course, particularly in areas of prime habitat for poisonous snakes and when traveling off regularly used trails.

Except for the extreme southern portions of the continental United States, all poisonous snake venom is of the hematoxin variety (as opposed to neurotoxins). These are relatively slow acting toxins which permit the individual time to make an appropriate choice of treatment. Hurried treatment is often more dangerous than no treatment. The use of snake bite kits is controversial. Anyone hiking in an area rich in poisonous snakes and where hospitalization is more than 6 hours away should make a thorough study of snake bite treatment.

Dehydration. Dehydration is a common problem among hikers but it is rarely mentioned except as an extreme case under hot conditions. Books on winter hiking and on mountaineering tend to give the problem more attention [See section on Specific Conditions, Danielson (2:26); and Ferber (5:34)]. However, indications are that most hikers tend to become dehydrated because they do not take time to consume sufficient liquids. Dehydration encourages fatigue and cramps by upsetting the body's electrolyte balance and hindering the elimination of acid wastes. A minimum of 2 liters of water should be consumed per day with the quantity increasing as climatic conditions warrant. Frequently the need exceeds the thirst response. When conditions require 4 liters per day, water should be consumed at every rest (20 minutes) regardless of desire. Small quantites consumed frequently produce fewer adverse reactions than large, infrequent doses, particularly if the water is cold.

Indigestion. There are a number of causes of indigestion among hikers. Spices and chemicals used to provide flavor and prevent spoilage often cause indigestion. Dehydration and electolyte imbalances may produce gastrointestinal distress as well. Indigestion problems can be reduced by adequate water and salt consumption, thorough food preparation and a less demanding hiking schedule. Many hikers have found it helpful to carry commercial antacid tablets on trips for those situations that seem to inevitably occur. Note that improperly rehydrated freeze-dried foods are often incompletely digested. Incomplete digestion can result

in the formation of large quantities of gas (through bacterial action on the undigested food) which can be very painful and temporarily debilitating (1:319).

Diarrhea. Diarrhea can be an extremely debilitating condition for the hiker. Most hikers acquire diarrhea from spoiled food or by eating from utensils that have not been properly cleaned. Utensils should be rinsed well if soap has been used. Soap often causes gastrointestinal distress and diarrhea (5:49).

Diarrhea upsets the fluid and electrolyte balance in the body. It favors fatigue, cramps, hypothermia and other ailments brought about by dehydration. Hikers should be encouraged to obtain, via their physicians, tablets that stop diarrhea. Over-the-counter remedies are not as effective as prescribed drugs. Also, they are usually in a liquid form which is heavy to carry and freezes. Since diarrhea can occur in the winter, salt tablets (preferably an electrolyte formula) should remain a part of the first aid kit all year.

Sprains, strains and broken bones. Most hikers are aware that there is a potential for the occurrence of sprains, strains and broken bones on all hikes. Generally standard first aid practices are sufficient. However, there are some considerations that are idiosyncratic to hikes and other outdoor activities.

A general rule with any ankle sprain is to avoid taking the boot off the injured foot. If the ankle is sprained, or even if it is broken, it may swell to the point that it is impossible to get the boot back on the foot. The walk out, then, has to be made barefoot or with an improvised (or cut) boot. On a paved trail this would not be too bad, but on rough trails and in the winter this would be disastrous. The boot should be left on the individual to control the swelling. If the ankle is to be soaked, soak it with the boot on. In winter, pack the ankle and boot in snow (don't soak), but watch for too much cooling and frostbite.

Any injury, particularly sprains, strains and broken bones, upset the body's metabolic processes. This upset favors reduced heat production and results in loss of body heat. Hypothermia is a threat even in the summer (See "Specific Conditions").

Sunburn. Sunburn is not only painful, but it upsets the body's heat regulatory system by reducing sweating (4:113). Sunburn can occur on overcast days, particularly in the summer. Sunlight reflected from rocks, water and snow can cause sunburn not only of the skin but of areas not generally burned by the direct rays; under the chin and inside the nostrils. Since the air provides some shielding from the burning ultraviolet rays, sunburn is hastened at the higher elevations where the atmosphere is less dense. Even persons who are tan can burn if exposed to sunlight for long periods (7:274).

Sunburn should be avoided by wearing protective clothing (hat, long sleeve shirt, long pants, even gloves). Protective creams are available at most pharmacies. Mountaineering shops carry products developed specifically for the conditions encountered while hiking, including special lip treatments and creams for high altitude exposure. Trip leaders should insist that sun worshippers cover up or stay home.

Sunburn on a hike can make movement difficult and painful. There may be swelling in severe cases. If sunburn is perceived to be a potential problem on a trip (trips in mostly wooded areas have a low risk) the trip leader should see that surface pain killers, as well as internal pain killers, are included in the first aid supplies.

Snowblindness — sunburned eyes. Snowblindness occurs when the eyes are burned by reflected sun from snow-covered surfaces. However, sunburned eyes can occur from light colored sand and rock in open areas such as deserts and Alpine regions. Water is another reflective source but generally is not a factor for burns in hikers. Remember, sunburns can occur on overcast days.

Snowblindness can be prevented by limiting the amount of light that is permitted to enter the eye. In particular the light coming from reflected surfaces (generally on the ground) should be reduced. Sunglasses or sun goggles are recommended. In emergencies very small holes cut in

clothing and then made into a mask will help. If the hiker wears glasses, adhesive tape can be placed over all but a small portion (slit) of the lenses (4:120).

Sunburned eyes should be treated by oral administration of aspirin (or other pain killer), cold compresses and a light-proof bandage. Recovery may take from 1 to 3 days. The victim may need to be led out to the road head (5:346; 4:120).

Frostbite. Frostbite is a condition that ranges from reduced blood circulation to an area (due to exposure to cold) to freezing of the tissue. It is brought about through contact with cold surfaces (especially metal), cold liquids, wind in association with cold, and in the case of the feet, after exposure to the cold for several hours.

Most hikers that encounter frostbite do so in situations where the temperature is slightly below freezing and the wind speed is moderate (20 mph to 30 mph). This combination produces cooling of any exposed skin (face, ears, fingers, etc.). While the condition produced is mild frostbite, it should be treated immediately or, better yet, prevented. Winter hikers carry hats, scarves, mittens and face masks to prevent frostbite. Hikers caught in a sudden weather change may not be so well prepared. Protective clothing may be made from towels (scarf), socks (mittens) and tee shirts (hat). Note: At very cold temperatures and high winds the face, particularly the nose and ears, can become frostbitten in a matter of seconds (2:20).

Frostbite of the toes and feet can be prevented through maintaining good circulation to the feet (avoid tight boots, constricting socks), a high caloric intake and dry socks next to the foot. Other factors contributing to frostbite of the hands and feet are exhaustion and heat loss from any part of the body; for example, the neck (4:119).

Minor frostbite can be remedied by placing the affected part on a warm part of the body (or someone else's body in the case of the feet). The face can be rewarmed by placing a soft piece of clothing over the frostbitten area, the thicker the better. Under no circumstance should the injured area be rubbed (5:341). Rubbing will cause further tissue damage and does not contribute to rewarming. Additionally, injured areas should not be subjected to rapid rewarming techniques that employ heat in excess of 38°C (100°F). Such rapid rewarming can cause additional tissue damage.

Persons planning winter trips or trips into areas where prolonged exposure to cold is anticipated should consult mountaineering texts for the proper method of treating severe frostbite. (Mt. Everest is climbed in the late summer and frostbite is a problem in spite of Everest's southern latitude — approximately that of Miami, Florida). A better method of learning about frostbite treatment would be to arrange for a demonstration by a physician who has had experience treating frostbite victims.

SPECIFIC CONDITIONS

The *Common Problems* discussed previously are impairments that are frequently contributed to by conditions such as *climate, terrain* and *altitude*. The following sections briefly discuss these factors pointing out areas of concern that leaders should study in depth.

Climate

Climatic conditions influence significantly the rate a hike progresses, the energy required, the amount of water required, and the degree of fatigue incurred. Climatic conditions are modified by terrain and altitude, but not always in the manner expected by novices. For instance, valleys are not always warmer than ridges because of their lower altitude. The presence of a river, trees and steep valley walls can make some valleys considerably cooler than the surrounding ridges.

Heat. Hikes that take place in a hot climate present the hiker with a potentially hazardous situation. Many hikers do not realize that heat can debilitate as readily as cold. A result has been

many situations in which heat has unsuspectedly debilitated a hiker.

The primary concerns of the hiker in a hot climate are dehydration, electrolyte balance and exhaustion. These conditions can occur regardless of whether the humidity is high or low, but, the dehydration rate, at least, is increased by a hot dry climate because a considerable amount of moisture is lost through respired air. Since the hiker must breathe, he has little control over this loss of water other than to remain stationary.

Dehydration is a reduction of the normal body water (fluid) content. It is primarily evidenced through the lack of a need to urinate and a dark yellow urine. The color of one's urine is the best indicator of the body's need for fluid. Thirst can be suppressed and sweating can occur until the body has dangerously depleted its water supply (4:131). As dehydration progresses, the hiker becomes increasingly inefficient and his body is less able to deal with the heat stress. If steps are not taken to reduce the heat load (stop exercising, seek shade) and replace lost body water, heat stroke (sun stroke) can ensue. Heat stroke is characterized by a high body core temperature, flushed and dry skin, dizziness and a very strong pulse. Remedial steps include cooling the individual via immersion in cold water, placing the individual in the shade and administering cold liquids to the victim.

Hikers frequently depend on ground water. In hot weather, ground water sources frequently disappear. Hikers should drink at every opportunity and refill canteens whenever possible. One water vessel generally overlooked is the stomach. A large quantity of water can be carried in the stomach if exertion is not strenuous. This could be a life saver in emergencies where as much water as possible must be carried.

Heat exhaustion occurs primarily when a non-acclimatized person exercises in a hot environment. It is brought about through shifts in body fluids from the major blood vessels to severely dilated blood vessels in the skin. The heart beat is weak and rapid, blood pressure is low (due to massive blood vessel dilation) and the skin is moist and cool. The body temperature is near normal. Treatment for heat exhaustion includes rest and the administration of salt and fluids.

Trip leaders should be on guard for heat exhaustion, particularly early in the summer or in trip participants who come from cooler climates. Significant heat acclimatization can occur in 3 to 7 days if the person exercises vigorously. Research indicates that persons who exercise in a hot environment are better acclimatized than persons who live in a hot environment but do not exercise (3: 276). While exercise speeds up the acclimatization process, weekend hikers should not be expected to be acclimatized. Additionally, persons living and working in climate controlled buildings should not be expected to be acclimatized to a hot environment even if the outside temperatures are high.

Heat cramps are brought on through the loss of electrolytes as a result of heavy sweating. Heat cramps occur in the skeletal muscles including those of the abdominal wall. Electrolyte balance can be maintained by consuming about 16 grams (4 level teaspoons) of salt per day (3:275). Hikers using commercial trail foods will find that many of the meals, particularly the dinners, have a high salt content. This salt can be used to reduce the supplemental doses taken at other times. Unfortunately, since dinner is generally the evening meal this salt does little to prevent cramps during the hike. In general, it is recommended that extra salt be taken on one's food in order to reduce the chance of nausea. Of course, there are commercially prepared electrolyte replacement beverages available.

Cold. Hikers preparing for trips in cold climates, particularly when there is snow and ice, generally should seek knowledge from books and experienced leaders. The reports of frostbite and hikers "freezing to death" are sufficient motivation to seek advice and skills. There is no question that frozen environments present serious hazards. Yet many hikers do not realize that serious problems with cold can develop anytime the environmental temperature is below 21°C (70°F). Proper care should be taken to assure that all trip participants have sufficient clothing

and other gear to sustain sudden changes in temperature accompanied by some form of precipitation.

Hypothermia, or low body temperature, is frequently referred to as "exposure" or "exposure sickness" and during colder seasons erroneously referred to as "freezing to death." Actually, the person dies when the body core temperature drops below 24°C (75°F) (4:117). A common misconception of some hikers that the temperature must be below freezing to present problems of exposure sickness has resulted in many deaths. Most hypothermia cases develop between 0°C and 10°C (32°-50°F) (5:339).

Hypothermia is a complex phenomenon that requires study to fully appreciate its importance to hiking safety. Almost every hiker has experienced hypothermia to some degree. Anyone who has shivered has experienced the initial stage of exposure sickness. While the ensuing paragraphs briefly discuss hypothermia, the hiker should devote additional time to studying the more complete discussions of hypothermia appearing in the references. Fear (4) has done an excellent job in explaining the complex problems of maintaining body heat balance.

Hypothermia can be caused or accelerated by: (a) wet clothing and skin, whether from rain, snow, sweat or wading streams; (b) wind, particularly in association with wet skin and clothes; (c) contact with cold objects (e.g. sitting on stones colder than body temperature); (d) radiant heat loss, particularly through an uncovered head and neck; (e) dehydration; (f) energy expenditures in excess of caloric intake; (g) illness; (h) injury, even minor cuts and blisters; (i) poor physical conditioning (fitness); and (j) drugs, including medicines like aspirin and alcohol. Frequently, several of these factors are in operation at the same time. Prevention of hypothermia requires an understanding of its causes and the skill to counterbalance the factors causing heat loss. There are many gadgets available to the hiker that are designed to facilitate the prevention of hypothermia. While some of these are useful, often the hiker carries so many gadgets that he becomes exhausted from carrying the extra weight. The most dangerous aspect lies in the fact that the "modern" hiker is often prone to place his trust (and life) in a device that may malfunction, become damaged or be lost rather than trust in his skill. Every trip leader (and really every hiker) should have the knowledge and skills to prevent and remedy hypothermia with a minimum of equipment (i.e. knife and matches).

With the exception of shivering, the symptoms of hypothermia go unnoticed by the victim. The cooling of the body reduces the functioning power of the brain. The victim becomes unaware of his problem. All trip members should be aware of hypothermia's symptoms and should watch for them in the other party members. At the beginning of a trip a few moments spent teaching the participants the symptoms may save a life. Vigilance and early treatment can minimize the debilitating effects of exposure sickness.

Besides shivering which can become extremely violent, other symptoms of hypothermia include: (a) impaired fine motor ability, including speech; (b) impaired logic or reasoning ability; (c) impaired gross motor ability; and (d) amnesia. Eventually the victim becomes unconscious and dies from pulmonary edema and cardiac arrest (4:104). When the body core temperature drops below 35°C (95°F) the heat regulatory system becomes inoperative. At that point the individual will not rewarm unless heat is added from an outside source, e.g. hot drinks, fire, another person (5:34).

Treatment for hypothermia (assuming preventive efforts have failed) should begin as soon as the individual begins to shiver. Inasmuch as possible, all of the factors that contribute to hypothermia should be mitigated. Food and warm fluids, even plain warm water, should be administered while the victim is still conscious. Hikers should ignore the tendency to trudge on in order to get out of the wilderness or find a predetermined camp and/or ideal campsite. "Toughing it out" can only lead to disaster as the progress of hypothermia is often very rapid. The time between the first signs and death can be less than 2 hours (5:340). Obviously, unconsciousness can occur in substantially less time.

Precipitation. Precipitation in all its forms represents a hazard to hikers. Wet clothing and skin conduct heat away from the body 200 times faster than when they are dry (4:102). The problem is compounded when evaporation is accelerated by the wind. Wet trails, particularly rocks and logs, are slippery. They present the obvious hazards which may result in falls. Heavy rains cause flash floods in desert areas and in mountain valleys with steep walls. Trails that require fording a usually shallow stream may present the risk of drowning after a rain. The trip leader should have alternate routes which do not require fording streams, or the necessary equipment and skills to get the group safely across the stream (See section on "Terrain"). Many trips require the crossing of several streams, hence backtracking may not be possible if the storm breaks after the first stream crossing.

Snow and freezing rain make trails dangerous. At the beginning and end of the winter, hikers should expect snow, sleet or freezing rain even though temperatures are generally above freezing. Besides the increased risk of falls, snow and ice slow down the progress of a hike and increase the energy cost. The trip leader should plan these factors into a trip by providing an itinerary that allows for delays and he should require each party member to carry extra food.

Wind. Wind is a climatic factor that can benefit hikers or jeopardize their lives. Air moving across bare skin cools the skin by increasing the rate of evaporation and heat loss through convection. In a hot climate this cooling can reduce the probability of heat stroke and heat exhaustion. In temperate and cooler climates wind becomes an enemy. The cooling process continually tries to force the body into hypothermia. It depletes the body's energy supply, often at an alarming rate. Under these conditions wind should be avoided and the body should be protected from it.

On every trip the leader should be certain that each participant has some form of suitable wind protection for the head, neck and torso. Often this need only be a windshell made of closely woven nylon. Such jackets, when purchased from an outdoor shop, generally have a hood attached. When trips are taken in colder climates wind pants are necessary as are mittens and other warm clothing. The chilling effects of the wind can be reduced by seeking shelter when under extreme conditions. Tents, trees, and the leeward side of any object of reasonable size can be helpful. Note: The greatest increase in cooling occurs when the wind increases in speed from 0-8 kilometers per hour (0-5 mph).

Terrain

The safety problems of various terrains are frequently mitigated by well constructed trails. However, not all trails are well constructed and some hikes take place over terrain that has no trail. Mountaineering expeditions usually include the traversing of terrain where no trail exists, particularly in snowfields. The trip leader should be familiar with the terrain through which his trip will travel. It is his responsibility to have the proper special equipment that may be necessary to safely convey the group through difficult places, including normally safe places made hazardous by rain, ice, snow or landslides.

Steep slopes. High angle slopes, whether made up of solid rock or of various soils, present hazards particularly if wet or covered with snow and ice. Normally firm soil softens when wet. The footing of the lead hiker may not be much affected, but as subsequent hikers traverse the area the surface material becomes loose and pasty; loss of footing and dangerous falls may result.

The insecure footing and its concomitant risks can be reduced if the trip leader has a climbing rope and the appropriate equipment to fasten it to the hillside. The leader must have training in proper uses of a rope and he must take time to instruct the individual party members in "safe" techniques, particularly for descending. (Note: These comments apply to hikes, not rock climbing or those aspects of mountaineering trips that require technical rock and ice climbing

skills). The trip leader must decide the distance that is considered to be safe spacing between party members. A fall by one member should not jeopardize members beneath him. The distance will vary depending on the specific conditions at the location.

Loose rocks. Some areas, particularly those above the tree line or where the trail ascends steeply up the fall line of the hill, present situations where rocks loosened by other hikers, or the elements, may fall on a party member. If this is a prevalent condition on a trip then the party members should be required to wear helmets. If the trip is only a hike without high angle climbs, a standard hard-hat would be sufficient. When rocks may fall vertically on a hiker, a rock climber's helmet would be desirable. Lookouts should be appointed to watch for falling rocks. Party member spacing should be established to minimize the possibility of several hikers being injured at once.

Trees — deadfalls. Hikers in the woods run the risk of being hit by falling trees and tree limbs. These occurrences can be brought on by climatic factors or by the hikers themselves. Hikers who use trees as hand holds while climbing steep trails may move the tree so that a limb breaks off it or a neighboring tree. Or, he may slip and pull the tree down on himself or on other party members. This latter hazard is very real in forests that have a largely organic soil overlaying bedrock. Under these circumstances, the trees' roots are shallow and the soil is too loose to provide the roots with much holding power.

Climatic conditions generate deadfalls in several ways. High winds may blow trees over, break branches or loosen those already broken. Lightning frequently blasts branches from trees, particularly those trees that have large quantities of sap. Storm-broken limbs generally make some noise as they break and, thus, give the hiker some warning. Snow ladened branches behave in a similar fashion. The most dangerous branches are those large dead branches, particularly those of hardwoods (notably the oaks) which rot before they break and fall. The rotten wood does not make much noise when it breaks, thus the hiker gets little warning unless the broken limb hits something else as it descends. The hazard is magnified since the limb fractures off the tree rather than bending and then breaking. The fracture permits the limb to drop almost vertically in a horizontal orientation so that the danger zone covers an area almost as long as the branch itself. The most dangerous times for this type of deadfall are during and immediately after a rain, and when there is a sudden increase in humidity. The rotten wood absorbs the moisture and, if the increase in weight is sufficient, the limb breaks. Hardhats might help in some situations, but the best safety procedure is to glance upward frequently.

Avalanches. Winter hiking is increasing in popularity. With this surge in winter hiking, and related activities like cross-country (Nordic) skiing, the need for an understanding of the hazards presented by avalanches has increased. Avalanches can occur almost anywhere a snow cover of a foot or more on sloping terrain is present. The greatest hazard occurs on terrain that is convex, having an angle of 30 to 45 degrees and having several layers of snow of different types (2:122; 4:249). Avalanches are caused by a number of circumstances including heavy, wet snow over dry, powdery snow; wind; rain; and undercutting through the layers of snow across the fall line.

To avoid avalanche hazards the hiker should keep in mind that the snow on a convex hillside is under a great deal of tension caused by gravity attempting to pull the snow down the hill. The snow hangs onto the ground surface and is further held in place by projections such as rocks and trees. However, if the hiker takes a path across the hillside he may release the tension by cutting the snow's connections with its anchors. An avalanche will be the result.

When in avalanche areas, the hiker should: (a) stay out of valleys, whenever possible; (b) seek trails along the spine of ridge, where possible; (c) hike through wooded areas (this will keep the hiker from producing an avalanche, but will not keep him safe from avalanches starting above the timber line or from rocky slopes); (d) travel at times when the temperature is below freezing and the sun is not on the snow to be traversed (night, early morning, late

afternoon); and (e) hike straight up a hill (up the fall line) rather than using switchbacks or traverses. Hikers should look up frequently to scout for signs of avalanches. Party members should be spaced well apart and trail an avalanche cord from their waists.

There are very few survivors from the large avalanches. The speed of the snow kills many hikers on impact. Those who survive the initial force are suffocated by the weight of the snow about the chest or the glazing over of the snow about the face. Rescue must be immediate to be effective. Winter hikers would do well to avoid known avalanche areas until they have read several books on the subject and travelled in avalanche areas under the supervision of experienced winter mountaineers.

Altitude

High altitudes, those in excess of 2700 meters (9000 feet), magnify hazards found at lower elevations and present new hazards to the hiker. At the higher elevations, the sun is more intense. Hence, sun related problems (burns, snow blindness) are accentuated. The air is dryer, therefore dehydration progresses more rapidly than at lower elevations. Hikers may need as much as 4 to 5 liters of water per day. (Obtaining 4 liters of water requires a considerable amount of time spent in melting snow.) Weather changes are often dramatic, sudden and severe.

Efficiency. The amount of oxygen in the air varies with the altitude. While the oxygen content of air remains 20.93 percent as high as man can hike, the density of the air decreases as the altitude increases. As a result, the hiker acquires less oxygen with each breath and the oxygen saturation point of his blood decreases. At 900 meters, work capacity is decreased by 5 percent as a result. This decrement increases to 25 percent at 2000 meters and continues to increase until minor efforts become exhaustive at 5500 meters (18,000 feet) (8:277). The hazard presented by the loss of efficiency does not lie in getting up or down the mountain. Rather it lies in the inability of the hiker to efficiently meet emergencies that call for vigorous activity such as reaching and evacuating injured party members, digging or rigging shelter from sudden storms and coping with avalanches. Hikers at the higher elevations should be highly skilled and knowledgeable if they are to survive.

Acute mountain sickness. Acute mountain sickness (AMS) generally occurs at altitudes in excess of 2700 meters, but it can occur at lower elevations, particularly in its milder forms. AMS is characterized by headache, nausea, vomiting, insomnia, impaired gross motor ability and hyperventilation (5:345). While current research in this area is incomplete, the condition seems to be that of metabolic acidosis brought about through hypoxia (lower than normal oxygen content in the air and, hence, the body). It is particularly prevalent in those hikers who live near sea level but who drive to a high elevation to begin a hike. However, even hikers who ascend mountains by foot may suffer AMS if the ascent is fairly direct and rapid.

If, in fact, AMS is caused by metabolic acidosis brought about by hypoxia, it can be prevented by: ascending to altitude gradually and taking (or eating) alkaline substances. A gradual ascent permits the body to increase oxygen transport by increasing the blood volume and hemoglobin content of the red blood cells (3:279). Cardiac output may increase temporarily. Exercising only moderately and taking frequent rests ("breathers" becomes an appropriate term under these circumstances) will help to remove some of the metabolic wastes. Since the kidneys must also remove some of the acid wastes, the consumption of large quantities of water should be helpful. Remember, the darker the urine the more water the body needs.

Mountain sickness can be treated with oxygen, if any has been packed in (a desirable safety practice on high altitude trips), aspirin, and rest. Anyone suffering from AMS should be removed to a low elevation as soon as possible to avoid complications. The victim should eat carbohydrates, particularly simple sugars, and fruits (except cranberries and plums). Proteins and cereals should be avoided because they produce metabolic acids (1:230).

Pulmonary edema. Ascent to high elevations, particularly at a rapid rate, causes hypoxia which may bring about congestion of the pulmonary venous system (10:335). The back pressure brought about by this congestion causes plasma fluid to enter the alveoli. The symptoms of high altitude pulmonary edema are similar to those of pneumonia, but there is an absence of fever (unless the victim has another malady). Symptoms occur between 12 and 36 hours after reaching altitude (2700 meters or more) and include shortness of breath, excessively high heart rate for conditions, nausea, vomiting, chest discomfort and blood stained sputum (5:341; 10:336).

Pulmonary edema may be prevented by slow ascents to altitudes above 2700 meters or by restricting physical activity to very mild activities for 48 hours in situations where altitude is gained rapidly.

Preventive measures may not always work. The victim can deteriorate rapidly. Anyone showing the symptoms of edema, particularly those with "bubbly" breathing and discolored sputum, should be evacuated to lower altitudes and given medical attention as soon as conditions permit.

AMS and pulmonary edema are complex medical problems that require special training for a trip leader to be able to treat them in the field. Either the trip should have competent medical personnel as party members or the leader should not plan a trip which makes reasonably rapid transportation to lower elevations impossible.

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Chapter 5

ICE FISHING

Ottar G. Draugsvold
Magnolia, Massachusetts

Ice. If with that word you picture yourself in an armchair, highball in hand, or watching T.V. hockey, you are not yet an ice fisherman. Sitting for long hours on a windswept sheet of ice during the dead of winter is becoming an increasingly popular sport. It is, of course, a moderately successful method of providing fresh fish for dinner long after the trout season has ended. There are several methods of practicing this ancient pastime: (a) jigging lures, (b) jigging bait, (c) bait sets with tip-ups, (d) bait sets with bobbers, and (e) spearing. Each of these is used for specific varieties of game fish in particular locales.

Long after your grey squirrel has hidden his store of winter acorns, the surfaces of nearby ponds and lakes begin to freeze over. This crisp, crusty bottom ice forms first around the edges then gradually extends toward the middle. Have you ever wondered why ice forms in this way or why it floats at all? As water cools down to 4° Centigrade, it assumes its greatest density. So, water at 4°C sinks down to the bottom; below 4°C it becomes less dense and floats up through the warmer water forming ice at the surface. This cold water is less dense because an interlocking crystalline structure much like crocheted lace is forming. The fact that ice floats has tremendous ramifications in the natural world and it also makes ice fishing possible. The ability of ice to bear loads is primarily a function of the two properties just mentioned, the crystalline structure and its buoyancy.

Adequate Thickness of Ice

How long should you wait after the pond is frozen over before giving it a try? How thick does ice have to be to support a 200-pound load? Ice and wood are comparable in measures of strength. Ask your local carpenter which is stronger; three inches of balsa wood or one inch of white oak. According to SIPRE (the Snow, Ice, Permafrost, Establishment) of the Army Corps of Engineers, four or five inches of new clear ice may be stronger than a foot of old discolored ice. If you are looking for ice to support your fishing club after a Sunday dinner, look for ice formed by slow, freezing, and stagnant water. Ice formed by the melting of snow, refrozen ice, or water refrozen on the surface might not support your beagle pups. Remember that ice is like wood — clear, straight grained, unwarped wood is the strongest. Air pockets and bubbles are to ice what knot holes and worm holes are to wood. If the pond has four or five inches of clear ice on it, the time is right, so button up.

Clothing

As you are thinking of how you should dress for this outing, keep one thing in mind; it can be and often will be much colder on ice than in your front yard. Does this mean you should buy down-filled pants and coats? Probably not. Remember you are going to be doing a lot of

walking and probably a lot of hole chopping. The secret to comfort on ice is layering your clothes. Take a lot along, but don't put it all on until you need it. Boots must be insulated and waterproofed for there is always some water on the ice around your fishing holes.

Figure 1. Proper clothing is essential.

Going Out on the Ice

When you reach the edge of the shore before you trudge out there like Admiral Perry, use your head. The first ice you step on is probably the weakest. Ice around the shore is often pushed over dry land by the pressure of the expansion of ice formation. So this ice isn't floating, it's just sitting there like a bear trap waiting to spring around your ankle. Loosen your boots up so that if necessary they can be easily kicked off under water. If you can see a trail where more "eager beavers" have already trod, follow their path. The ice is probably safe and perhaps one of these other fisherman knew where he was going and why. Don't strap and hang your gear picturesquely from your body. The chances of someone taking your picture are pretty slim. Borrow one of the children's sleds, put your duffle on it, and trail it behind you. If you break through, you won't appreciate your gear pushing you under or hampering your climb out.

If the ice is clear and wet, clampons (metal cleats attached to boot bottoms) will keep you from doing a split. If you have no trail to follow proceed slowly. Chop holes frequently to check ice strength, perhaps every hundred yards if it is very early in the season. If you are going fishing on a river you know very little about, stop! Early river fishing without intimate knowledge of the river may often lead to a fatal accident. Remember, rivers are moving bodies of water, so river ice is never as strong as nearby lake ice. Some rivers like the Mississippi have channels that change rapidly and unpredictably, especially early and late in the season. Yesterday's "sure thing" may be "today's bath."

If you are venturing out on a large lake, take a compass along. Raging blizzards are a possibility and heavy fogs which obliterate your landmarks are quite likely especially along bottom lands in the springtime. Of course, a compass is useless unless you know how to use it and keep track of your direction of travel. The trails of many ice fishermen on large lakes often look like a child's attempt to copy the letter "S." It's easy to walk a straight line (when sober) by lining up two distant objects, one about half-way between you and the farthest. You can walk a straight line to the nearer of the two objects, ice conditions permitting. Walk slowly. The two-mile track at a military pace across snow crusted ice is very tiring and will cause you to perspire. Once you are perspiring staying warm when you begin to fish may be very difficult.

As you stroll along with your companions, keep your eyes open. Some inconsiderate fishermen don't mark their holes when they leave them. Remember refrozen ice? A soaked foot or a broken leg will end your trip before your first hole is chopped. The presence of solid objects such as rocks or pilings frozen in the ice, signals weaker ice around these objects. As ice freezes, it exerts pressure on them and they push back against the ice. This causes the ice to melt and refreeze, sometimes repeatedly. Remember what was stated previously; refrozen ice is always weaker. Another result of the push of expanding ice which is common on large lakes with steep shores is pressure ridges. In this situation, the ice cannot relieve the pressure by sliding up on the shore, so one part of the sheet breaks off from the rest and partially slides up over it. There is frequently open water or very weak ice between the two edges of the sheet. There is always some danger in crossing a ridge, but if you must cross one, choose the safest spot carefully. Hand your companion one end of a 30-foot rope while you cross, then do the same for him. Pressure ridges are to ice fishermen what fences are to hunters.

Whenever you walk on ice, the only gear on your body should be 30 feet of loosely coiled rope, your lifeline. This shouldn't be a clothesline but either a ¼-inch nylon or a ½-inch hemp rope. Even when walking alone this can save your life. Your potential rescuer may not have anything to reach you with except your lifeline.

If you have decided that driving your car across the ice to your proposed spot is better than walking across the ice, there are several important considerations. First, it's more dangerous than walking. Due to the differences in weights of cars and the vagaries of ice, there isn't a rule of thumb to follow concerning minimum thickness. During the German seige of Leningrad in World War II, the Russians' only supply line was across the heavily frozen Lake Ladoga during the winter. Due to the inconsistencies of ice, they lost hundreds of trucks and drivers. Cars traveling on ice set up resonance waves within it. These waves resemble the action of a whippy ultralight fly rod. The period of these waves, the time between crests, is dependent on the depth of the water beneath the ice. There are certain critical speeds for various depths that must be avoided. According to SIPRE, these critical speeds are: for 4 feet of water, 9 miles per hour; 6 feet of water, 11 miles an hour; 8 feet of water, 12 miles an hour; 10 feet of water, 15 miles an hour; 30 feet of water, 22 miles an hour. A good rule of thumb to follow is to drive no faster than 5 miles an hour until you are sure you are over deep water on good ice. Tailgating on ice can be as disastrous as it is on the highway, due to wave build up.

Handle your tires on ice the same way you would in heavy beach sand, deflate to 10 or 15 pounds. Even though it is cold outside, when driving a car on ice, all windows should be rolled completely down. The doors should be left ajar and no seat belts fastened. According to police accident records, when a car breaks through the ice, the front end, the heavier end, usually goes in first. If this happens to you, immediately throw the transmission into neutral and get out of the vehicle. Cars seldom sink so suddenly that there is insufficient time to escape. Of course, this should never happen if you scout out the entire route of travel on foot first. If you have any doubts about the ice strength leave your car ashore.

In the last decade, the raucous sound of snowmobiles has invaded the previous near solitude of ice fishing. The snowmobile handles quite well on ice, but a minimum of six inches of new

ice is required to support a 400-pound snowmobile safely. One common aggravation with these vehicles is that the runners may freeze into the ice during a prolonged stay. So be alert!

Selecting a Site

After you have finally arrived at the spot temporarily littered with fishermen, shanties, cars, gears, snowmobiles, and possibly a few frozen fish, what's next? If there is a lot of heavy gear in a small confined area, better move a little further on unless the ice is very thick, at least 18 inches. SIPRE has calculated that cars parked on one foot of ice will deflect it one inch in a circle of 200 feet in diameter around the car. Imagine what happens when several cars are closely parked around numerous shanties with hundreds of holes. Part of ice's strength comes from its resistance to bending so it gets considerably weaker when bent out of shape. If others park near you, at least move your car or you may be walking home.

If your favorite spot hasn't become a parking lot, it's time to fish. Before you do anything else, put on your dark sunglasses especially if the ice is snow-covered. You don't have to be north of the Arctic Circle to become temporarily snow-blind. Fifteen years ago, every experienced ice fisherman had his own personal spud, usually homemade, for chopping holes. A *spud* is a large chisel on one end of a six foot metal pole with a handle and hand strap on the other end. However, most fishermen today use a screw-like device called an *ice auger*. The auger is far superior. It's inherently safer, easier to use, easier to control, and cuts a neater hole with less effort.

There are certain areas on any lake or river usually near a spring where fishing is consistently better than elsewhere. In the winter, these spots often become the sites for numerous shanties. Most shanties are a little more than glorified outhouses providing a place to sit, a hole in the floor to fish through, and protection from the wind. Like any good outhouse, a shanty needs adequate ventilation if you plan to burn anything inside. Don't believe what some manufacturers of heating devices may claim. The combustion of any hydrocarbon results in the formation of carbon monoxide gas. Without proper ventilation, your shanty can easily become your coffin due to carbon monoxide poisoning. The same ventilation requirements exist for the less common portable fabric shanties. Anchor your temporary home deeply in the ice at all four corners. After every winter blizzard in Wisconsin, shanties are blown three to six miles across Lake Mendot because they aren't properly anchored. Flying or sliding shanties are bound to create an unnecessary hazard.

Falling through the ice

Unless you heed what has been outlined up to this point, you are eventually going to be taking an unexpected water bath. Your chances of meeting with success after falling through the ice depend on following the advice of the experts. As you go under don't panic and thrash about. Keep your face above water but don't immediately attempt to climb out. In spite of what you have been told, you can stand freezing water for sometime before succumbing to hypothermia. The record for cold water survival is held by a man who remained swimming in the 30-degree Bering Sea for nine hours! He wasn't specially dressed for his swim either.

The more realistic survival time for most people in ice water is about 25 minutes. At any rate, your immediate danger is drowning, not freezing. The air trapped within your clothing is usually sufficient to float you high enough to keep your face out of the water. So, don't lose its benefits by trying to take off your heavy clothes. If your boots were loosely tied, kick them off. If not, forget about them. Break the ice around you with your hands until you find some strong enough to hold onto and yell for help. If you have your 30-foot lifeline, your most serious troubles are over when someone gets within that range. If you don't have a rope and your rescuer doesn't either, have him crawl to you extending anything you can grab onto and help

pull you out. Both of you should lay spread eagle on the ice and roll until well clear of the site of the break. If you are isolated with no chance of rescue, after you have found reasonably strong ice, kick your feet as you pull up and roll away from the break site.

There are several carbon dioxide powered flotation devices on the market. The only one worth considering is used by divers to ascend from deep dives. It is heavily constructed and utilizes two separate CO_2 canisters to inflate. These devices are not Coast Guard approved because they aren't 100 percent reliable. However, if you must travel on tricky ice, take one along and wear it.

Ice fishing isn't particularly dangerous if you know what you are doing and what you are doing it on. Remember and follow these rules:

I — Ice, know yours
C — Car's requirements
E — Exact knowledge of conditions
F — Friends, always take one
I — Insulation, layer your clothing
S — Shanties, vented and anchored
H — Head, use yours
I — Immersion, know what to do
N — Numbers of people, change conditions
G — Gear, tow it, don't wear it

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Chapter 6

ICE SKATING

Kurt Oppelt
The Pennsylvania State University
Cathleen Pavlis Oppelt
State College, Pa.

Ice skating is one of the oldest means of locomotion. It was used many thousands of years ago in the Austrian-Swiss Alps as a means of transportation over the frozen lakes from pole house to pole house. At this time skates made of bone and greased with bear fat were fastened with leather straps to the bundled feet of the natives. In the city library of Bern, Switzerland a pair of bone skates is housed which was found in a nearby lake and are believed to be well over 4,000 years old. Via Holland (canals) and Scandinavia (fjords) skating spread over the whole continent and later across the world. Since the natives used long sticks or poles to push themselves forward, one can see the relationship to the forerunner of cross country skiing and downhill skiing as well.

Description and Principles of Ice Skating

Ice skating is a method of moving over large sheets of flat ice with the help of ¾-inch steel blades of 5/32-inch width, mounted to special high boots. Motion is achieved by swinging side steps from the sole of the boot to the hip with the use of the knee as a shock absorber when the blade is firmly placed on the ice.

The skater's weight on the blade creates pressure and friction, which in turn creates heat, which melts the ice. Thus the skater glides in the direction of the length of the blade on a created film of water which quickly freezes over as the sharp edge of the skating blade passes over it.

Ice Skates

The basic skates consist of boots with steel blades mounted to the sole. These skates will vary in size and shape depending upon the skater's size, weight and the type of ice skating to be done (figure skating, ice hockey, speed skating, beginning ice skating, ice skating for therapy with the help of assisting devices).

In order to skate well and safely, one must observe the most important factor, "proper" fit of the boots. The skates, regardless of their type, must fit snugly. Only thin socks or stockings should be worn. The toes must touch the front of the boot with the heel holding firm in the back of the boot. The blade should be felt between the big toe and the second toe in the front and under the center of the heel in the back. The blade must be kept sharp and the boot must be laced up snugly without impeding circulation. Loose clothing should be worn in order to give the body freedom of movement and should also be heavy enough to give the body necessary warmth.

Ice Surfaces

Ice surfaces can be "artificial" (outdoor or indoor) ice either frozen from the bottom via pipes put in the ground and chilled by ice machines, or made from plastic compounds. Ice can also be "natural" (ponds, lakes, tennis courts, courtyards, swimming pools) with the freezing occurring from the top.

Regardless of whether the ice is artificial or natural, one must make sure that the surface is clean, without cracks, bumps, ruts, soft spots, sticky snow spots and is not overcrowded.

Safety

Ice skating is governed by rules in artificial commercial ice rinks with the help of instructors, rink guards and common sense. This means that races, games (such as tag, crack the whip, long jump etc.) are prohibited. In addition, hockey, figure skating and dancing should be avoided when no special areas are made available. Proper fitting skates and the help of qualified instructors are essential for safe ice skating. Once this has been established, one can also look to skate on natural surfaces.

Ice skating safety on natural surfaces is not as highly regulated as on artificial surfaces. Often one is left to use his own judgment However, natural surface areas are often equipped with a nearby shed containing safety equipment such as ladders, ropes and blankets.

When natural surfaces begin to freeze, one must be aware of the thickness of the ice; the depth of the water beneath; the movement of the currents below the surface which affect the consistency of the surface thickness; ruts, cracks or snow covered surfaces.

Principles of Safety

1. Never skate alone on any natural surface covering a lake, pond, shallow creek or river.
2. Never skate in large groups unless the ice is known to be thick enough to carry the weight of an automobile.
3. Skate only with people who are familiar with the skating area.
4. Beware of sun spots and crystallized ice.
5. Do not ice skate in the late spring since the ice begins to melt from underneath at this time of year.
6. Preferably skate on surfaces that have a water depth of no more than three to four feet.
7. Beware of refrozen surfaces. These can be very dangerous since the ice might well appear to be frozen in depth and in reality it is weak.
8. Be cautious of snow coverings on the ice surface. Due to the weight of the snow, hairline cracks may appear in the ice and therefore the danger of breaking through the surface is increased.
9. After a fall on the ice, be sure to pull both arms in toward the body to avoid being cut by another's skate blade.

Breaking Through the Ice

In the event that a skater falls through the ice, there are several very important steps to be taken. First, the most important step is not to panic. A person falling into icy waters often goes into mental and/or physical shock. It is commonly known that sub-freezing waters can cause a person to collapse and even the best swimmer may drown in minutes. In addition to the cold temperature of the water, heavy clothing absorbs the water and the added weight helps to pull the victim beneath the surface. Therefore, one must maintain emotional control and not rush to the spot where the victim fell in.

Second, one must slowly move toward the area of broken ice and listen carefully to the sound of the ice. Stop at once if you hear cracking sounds. You will be no help to the victim if you go through the ice as well.

Third, if possible, if no ropes are available try to form a human line by lying down on the ice. Hold on to one another's skates. Try to make the human line wide and long. The wider and longer the line is, the safer it will be as you get near the area of the break.

Fourth, if you have a rope, throw it to the victim for grasping. Slowly pull the rope back or move the human line away from the accident spot.

Fifth, use ladders, boards, coats or whatever else is available at the scene. Make the area as wide as possible. It is imperative that the weight of the rescuers be distributed. You want to create as little pressure on the ice as possible. The wider the surface area over which weight is distributed, the easier it will be to get away from the hole without breaking in over and over again.

Sixth, in the event of breaking through the ice without companions nearby to help, the most important rule is to stay as calm as possible. Try to get your arms over the side of the ice and try to slowly move your chest over the edge of the ice. Should the ice break, you can move forward until a place is reached where the ice holds. Ideally, anyone who skates on a lake, pond etc. should carry with him a small ice pick, knife or special gloves with picks mounted into the palms. With the help of these devices, one can pull himself onto the ice which will hold the body area and roll away from the hole. Should one fall into shallow water and the ice seems not to hold, simply break the ice over and over while walking to the edge of the surface and dry land.

Summary

Ice skating can be a very enjoyable recreational or therapeutic activity when the principles of safety are observed. Skating is recommended when the ice is ¾ to 1½ inches thick either on an artificial rink or on a surface where water is accumulated for the purpose of skating (e.g. flooded parking lot or tennis courts). Skating on a pond, lake, shallow water, creek or river is only recommended if one is familiar with the area, current, and the thickness of the ice. The ice should never be thinner than 5 inches, preferably 10 to 15 inches thick. The following are recommended for a safe and enjoyable skating experience.

1. Take lessons the first time skating from a qualified professional. Well-meaning friends unfortunately overlook many essential points.
2. Use proper fitting equipment and dress properly.
3. Always skate in the company of other people.
4. Have assistive devices available in the event someone should break through the ice.
5. Never skate in case of doubt or where contrary to one's common sense.
6. If lightning should ever appear, remove skates immediately since the steel blades can act as conductors, and seek refuge immediately on dry land.

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Chapter 7

SKIING

Jack M. Toney
University of Washington
James G. Garrick
Phoenix, Arizona

Skiing is almost unique among sport and recreational activities. Not only are there two basic types of skiing (Alpine and Nordic) but either type can be enjoyed as a casual recreational outing, a quest for greater perfection of technique, or a fiercely competitive sport. The opportunity to ski can easily span seven decades of one's life, females have the same opportunities as males, and disabilities such as loss of sight, hearing or a limb do not preclude one's participation. Is it any wonder that over five million people ski?

The Appeal of Skiing

There is little doubt that skiing has a psychic appeal. Skiing affords an opportunity to pursue an outdoor activity during the winter. It can offer the thrill of speed or the challenge of skiing a steep slope for the first time, or maybe with a little better technique than one skied it the time before. One can seek the solitude of skiing by finding a seldom skied run through deep snow, or the relative frenzy of the crowded, packed slopes. The clothing and equipment of the sport can also contribute to its glamour and appeal. To be sure, the frequent style changes, coupled with present fashion trends, allow the skier to display more than just his or her ability to perform the maneuvers of skiing.

A few years ago when one talked about skiing it was almost invariably about Alpine or downhill skiing. Alpine skiing is usually done at designated areas which provide equipment to transport skiers up the hill so that they can ski down. The downhill or Alpine skier almost always pays for the right to use that equipment.

In the last few years, there has been an appreciable growth in the number of participants in cross-country or Nordic skiing. Cross-country skiing differs from downhill skiing in several important respects. First, cross-country skiing can be done virtually anywhere where there is enough snow to cover the ground. The cross-country skier does not need significant terrain variation in order to engage in the sport. Because the cross-country skier does not have to ski in a designated area, he rarely has to pay for the privilege.

In addition, cross-country skiing differs from Alpine skiing in terms of the equipment used. The total weight of the boot, skis, poles and bindings used by a cross-country skier typically is less than the Alpine skier's boots alone. This lack of weight is achieved in several ways. Cross-country skis are significantly narrower and thinner than Alpine skis. The boots used in cross-country skiing are not primarily designed to offer support and therefore none of the weight associated with accomplishing that purpose is necessary. The cross-country skier's boots are really nothing more than athletic shoes which can be affixed to the bindings.

The bindings are also much lighter but it is not their weight alone which differentiates them

from Alpine ski bindings. Cross-country bindings usually hold only the toe of the boot to the ski and the heel is free to move up and down. It is the ability to lift the heel which allows the skier to perform the movements characteristic of cross-country skiing. The equipment used in cross-country skiing is also only about half as expensive as the equipment used in Alpine skiing.

Finally, the injury rate in cross-country skiing is significantly lower than the injury rate in Alpine skiing.

Skiing Safety

Skiing safety is usually discussed in the negative sense. Certainly, to many people, the mention of the word skiing calls up images of otherwise healthy people, walking with the aid of crutches, with a lower extremity encased in plaster.

Much misunderstanding surrounds skiing safety. Many widely held opinions relating to risk of injury and ways to reduce risk are completely unsubstantiated by fact. Certainly, the emphasis on leg fractures is indicative of the misunderstanding which exists. First, only a very small minority of injured skiers actually experience leg fractures. Secondly, while a dramatic injury, the fractured leg, in terms of its long-range implications, is not necessarily the most severe injury which a skier can experience.

On any given day, the individual skier is exposed to a very low risk of injury. Despite that low risk, however, it is real and both the skier contemplating taking up the sport and individuals responsible for the welfare of other skiers, such as directors or chaperones of ski clubs, should be aware of the risk of injury in skiing, the relative risk of various groups of skiers and factors to take into account in both increasing the safety of all skiers and dealing with the problems which arise when a skier is injured.

Reportability and Causation

There are two significant impediments to productive discussion of the injury problem in skiing. The first of these is the problem of reportability. The second of these is the question of causation.

The problem of what injuries should be reported limits the ability of researchers to determine the total number of injuries in skiing which occur in any one season and consequently makes it difficult to determine an accurate estimate of the injury rate in this sport. A reasonably satisfying definition of a reportable injury is "a physical disability suffered as a result of skiing or using uphill transportation which limits or prevents normal activities for a day or more." It is a common practice to express an injury rate in terms of the number of injuries per thousand activity days or in this case skier days. At Alpine ski areas there are usually either representatives of an organization called the National Ski Patrol System, or professional ski patrolmen whose role among others is to provide first aid to injured skiers. Because many of the more severely injured skiers do seek first aid from these people, the total number of injuries seen by ski patrols is felt to be a fairly good representation of the total number of skiing injuries in the country. It was accepted that not all injured skiers were seen by ski patrols, but it was assumed originally that the skiers bypassing the ski patrols had only minor injuries.

Garrick and Kurland (1) and Spademan (4) were among the first to conduct research which indicated that only a minority of ski injuries were seen by ski patrols and that some injuries, even significant ones, bypassed the ski patrol and were taken directly to physicians for treatment. Garrick's investigation also discussed the factors influencing the probability that an injured skier would report his or her injury to the ski patrol.

Based on ski patrol injury reports, the injury rate for Alpine skiing was estimated to be between three and four injuries per thousand skier days. With improved transportation between major skiing centers and major population centers and with the proximity of major ski areas to

major metropolitan areas, an increasing number of ski injuries are not treated at the area where the injuries have occurred but instead the injured skiers go directly to their family physicians or to hospital emergency rooms in the cities or towns where they live. Finally, many injuries are not treated by any trained paraprofessional or professional medical personnel. Recent work by Requa et al (2) and Shealy et al (3) demonstrates the value of using closed populations to investigate both reporting patterns of ski injuries and also to determine more accurately overall injury rates. As a result of such research, a more accurate estimate of the overall injury rate in skiing would be between eight and ten injuries per thousand skier days.

Investigation of the causes of injuries is greatly restricted by problems of reportability. There is keen interest in determining the ability of various types and brands of equipment and maintenance practices for equipment to reduce injury rates. It is impossible to be conclusive regarding the ability of such factors to reduce or conversely to cause injuries without knowing the number of people injured using these items of equipment or techniques. Despite such difficulties in analyzing causation, many statements regarding the ability of equipment to reduce injuries have been made and they contribute to some of the misunderstanding surrounding ski safety beliefs.

Skier Characteristics and Risk of Injury

While overall risk of injury is low, various subgroups of the skiing population have been identified, based on research, as being at greater risk than others. Younger skiers, less experienced skiers and those with less skill have a higher probability of being injured than other skiers. In addition, the injury rate for female skiers is slightly higher than the injury rate for males. Therefore, people who are responsible for skiers with those characteristics should be aware of the somewhat higher risk of injury and should be better prepared to deal with injured skiers for whom they are responsible.

Figure 1. Good technique leads to enjoyment of skiing and the outdoors.

The Skier's Environment

Skiers, as individuals and as groups, should develop an awareness that the skier's environment does pose threats to safety. A recognition of that can hopefully lead to preparations and alertness which will reduce injuries. The skier's environment in fact starts with the problem of getting to the ski area. In most cases, skiing is an off-campus activity. The possibility of motor vehicle accidents is in itself an important consideration. The journey to the ski area often takes place over winding, and ice covered roads, through hilly or mountainous terrain. On the more frequent week-end trips to the ski areas, the roads are often crowded with vehicles going to the same place. Falling snow and fogged windshields and rear windows add to the possibility of accidents. Because of the possibility of accidents on the way to the area, several recommendations for safe driving should be followed: 1) skis, boots and poles should never be carried in the passenger section of the vehicle; 2) drivers should have adequate protective sunglasses available; 3) ski boots should not be worn by the driver of the vehicle while driving to and from the ski area.

Once at the ski area, the most significant aspect of the skier's environment is the snow covered terrain over which the skier will ski. While nothing can be done to reduce the force of gravity which allows the skier to slide over the snow on his skis, the individual skier's awareness of two customary ski area practices will increase the probability of the skier reaching the bottom of the hill safely. First, most ski areas provide free of charge small maps of the ski area which indicate the layout of the trails at the area and also the relative difficulty of those trails. Second, the current universal system of trail markings classifies various ski slopes as to difficulty in a way which is consistent among ski areas.

Once out on the hill, the skier should note the difficulty of the slope or trail before skiing it and avoid skiing those which, according to the signs, are beyond the skier's ability. Obviously, as long as there is nothing except the sign to deter the novice from attempting to ski a slope beyond his ability, some skiers will experience the confidence destroying experience of a long and often frightening journey down a too difficult slope. Class instruction or supervised group skiing can alleviate this problem.

Another facet of the skier's environment which can also be associated with injuries is the equipment which is used to transport the skier up the hill. Equipment types with which the individual skier has had no prior experience and even familiar types at areas new to the skier's experience, require extra attention if problems in loading and unloading are to be avoided. Fortunately, the well-managed ski area not only posts directions regarding the proper method of using the various types of uphill transportation, but also provides assistance to the inexperienced skier using the lift for the first few times. The skier must, of course, indicate a lack of familiarity with the equipment to receive such assistance. Frequently, the bolder, younger skier is not likely to mention this need. Orientation by those responsible for young skiers can increase their awareness of the need to request assistance when necessary.

The four principal types of uphill transportation are: chair lifts, T-bars, poma lifts, and rope tows. Current research suggests that when compared to chair lifts, poma lifts, T-bars and rope tows all pose additional problems for the beginning skier. This is probably due to the fact that to use this equipment the skier has to ski up the hill as well as down.

Two other aspects of the skier's environment also warrant attention. The first of these is the frequently high altitude of western ski areas. Programs for school-aged skiers are usually conducted at ski areas not too far distant from the towns where the skiers live and therefore the problems of acclimatization to high altitude atmospheres are not great. On occasion, however, groups of skiers from the midwest or the south are taken to ski areas in the high elevations of the Rocky Mountains. The skiers going into those areas should be aware that some adjustment to the high altitude is needed. The adults responsible for those skiers should be aware of their own need for acclimatization as well.

The second factor deserving attention is the potential danger posed by inclement weather at ski areas. Extremely cold temperatures pose the threat of frostbite. In damp or wet weather, even at temperatures above freezing, the improperly dressed skier is exposed to the risk of hypothermia. In the latter case especially, it is possible for the skier, particularly the young one, to be in an advanced and dangerous stage of hypothermia without being aware of the problem. Again, those responsible for the well-being of young skiers should be particularly watchful during foul weather and advise the skiers to seek shelter in the day lodge when necessary. Unfortunately, the desire to get their money's worth sometimes leads skiers to suffer more from the weather than they should.

Ski Equipment

The most frequently discussed topic in ski safety is ski equipment. Frequently binding malfunction is blamed for injuries but often because there is nothing else to blame. Particularly as a result of advertising, skiers have been led to believe the particular types of bindings, anti-friction devices and binding adjustment systems can all reduce probability of injury. Regardless of these claims, however, there are fewer data that indicate the ability of any binding type or brand, anti-friction device or adjustment system to significantly reduce injuries. This statement should not be construed as advice that the skier not use established brands of equipment but instead should contribute to an awareness that reliance on one's equipment alone for safety will probably negate what safety values the equipment has.

There are several guidelines which skiers should observe in order to enhance the contribution of their equipment to reduction of the risk of injury. First, equipment should be matched to the skier's ability. While price sometimes indicates quality, expensive ski equipment is often designed for the more advanced or even the competitive skier. If used by the less experienced skier, such equipment could even increase the risk of injury or at least reduce enjoyment of skiing. Secondly, ski bindings must be installed properly.

Fortunately, many ski shops can be depended upon to properly advise new skiers in the choice of equipment and are also most qualified to install that equipment. It is best to leave the mounting of ski bindings to ski shop personnel. Those unfamiliar with the function of ski equipment, even if most able craftsmen, are not qualified to install ski bindings.

A controversial topic in ski safety is the matter of binding adjustment. Nevertheless, it is recommended that both new bindings and those which have been on skis for some time be checked at least seasonally, using mechanical binding adjustment calibration equipment. All major bindings are designed so that release is symmetrical, i.e., so that equal forces will cause a binding to release in the medial and lateral direction. The use of a binding test device can verify this symmetry. If forces of different magnitudes are required to cause release medially and laterally, the symmetry of the binding system has been disturbed and the binding is not functioning properly. Asymmetry can result from protruding screwheads, improper alignment of heel and toe unit, corrosion of binding units and a host of other causes. The cause of asymetrical release should be determined and corrected by ski shop personnel.

Equipment which is not new warrants checking at the beginning of each ski season. The use of binding test equipment will indicate whether the previous season's use and subsequent storage have caused deterioration of the binding system. Formerly, a cause of such deterioration was frequently the warping of leather boot soles but current boot design using plastic soles has reduced that problem. If one is unable (or unwilling) to have the bindings professionally checked a good rule of thumb is that, while standing on the skis, the skier should be able to "twist out" of the toe pieces.

While the boot-binding system is the most frequent focal point of discussions regarding ski safety, other equipment such as the ski itself, poles and clothing can cause injuries. Lacerations

resulting from the ski's metal edges are frequent ski injuries. In part, these injuries are abetted by the use of such retention systems as Arlberg straps to prevent runaway skis. Nevertheless, a desire to reduce risk of injury from one's own skis should never lead to elimination of some form of retention system. There are on the market, however, spring loaded metal devices (ski brakes) which will stop the ski that has been released from the boot by digging into the snow. These devices may have the potential to reduce risk of injury to both the user of the ski and others on the slope. In addition to reducing risk of injury to others, it should be noted that the problems associated with retrieving a runaway ski can also be extreme.

While the sharp tip of a ski pole can cause injury, most injuries caused by ski poles are caused by the straps. Ski pole straps are designed and used to prevent loss of the pole but a pole is rarely dropped without cause. These causes include the basket of the pole becoming caught on a tree limb either above or below the surface of the snow or the sharp tip of the pole becoming embedded in hard packed snow or a stump or the earth beneath the snow. In such instances the skier would usually be safer if the pole were lost. Catching a pole in one of the manners just described while it is attached to the wrist with a strap can cause shoulder dislocations and wrist and hand injuries that would not normally occur if the pole were released upon being caught.

Among the current fashions on the ski slopes is clothing made of the so-called "wet-look" fabric. Despite its contribution to style, wet-look fabrics have also increased risk of injury for some skiers. A skier wearing this clothing who has fallen on a steep hard-packed or icy slope can begin a slide which will accelerate to speeds sufficient to cause severe injury if the slide ends with a collision with a fixed object such as a tree or rock. In Europe some skiers whose falls would have been otherwise inconsequential have died from injuries suffered at the end of uncontrolled slides. Therefore, it is strongly recommended that skiers of beginning or intermediate ability not ski steep slopes while wearing such clothing. At some ski areas, skiers wearing wet-look clothing are forbidden to use the upper or steeper slopes.

Injuries

Most ski injuries are usually mere nuisances, forcing the skier to take off a few days from the sport. Even the more severe injuries do not often deter skiing for more than a week or two in the majority of cases. Approximately one-sixth of ski injuries are a combination of cuts, scrapes, and bruises. After appropriate first aid many of these injuries will permit further skiing on the same day. Somewhat more than one-half of ski injuries are sprains or strains. Sprains range from the minor ones from which the victim will recover to normal activity after a few days of rest to the more severe which require surgical intervention. Because of their long-term implications for potential disability and because delay can preclude effective treatment, it is recommended that skiers who experience serious sprains have them examined by a physician. The remainder of ski injuries involve fractures. The term fracture or broken bone elicits visions of suffering on the ski slope while waiting for the ski patrol to bring the toboggan, months spent in plaster casts and the potential loss of future ability to ski. Despite such ominous visions, the fact is that almost all skiers suffering fractures will be able to ski again, and in many cases during the following season. Needless to say the decision regarding the time to return to skiing must be made by the physician. It is also worth emphasizing that victims of severe injuries who return to skiing successfully were diligent in their performance of rehabilitation exercises.

Recommended Safety Procedures

Fortunately, there are a number of factors at work to increase safety in the sport of skiing. Among the most common and commendable are the activities of ski patrols. There are two types of ski patrols at ski areas. One type is the National Ski Patrol System which is composed of volunteers. At many areas, especially major resorts, there are patrols composed of profes-

sional personnel as a substitute for or in addition to the volunteer patrols. The National Ski Patrol System establishes and teaches optimum methods of handling injured skiers by its personnel. While the actual first aid is consistent with the recommended American Red Cross procedure, the transportation methods have been developed by the ski patrol organization. Ski patrols and patrolmen affiliated with the National Ski Patrol System are usually identifiable by the fact that they wear a rust-colored parka with a blue and gold patch displaying the words *National Ski Patrol System*. At areas where the rust-colored parka is not worn, patrolmen can usually be identified by the white cross on the backs of their parkas.

Professional ski patrolmen also undergo formal training programs to prepare them for their work. Many of those who work at resorts in the mountains of the Western United States are also trained in avalanche control and rescue techniques and mountain rescue techniques. Some of these professional groups are not affiliated with the National Ski Patrol System but this lack of affiliation implies nothing regarding the competence of professional ski patrolmen.

Regardless of the ski area's ski patrol affiliations it is of absolute importance that the area selected for organized student skiing have a ski patrol of adequate size and training. Without such a condition being met, determination of the type and severity of the injury as well as the probability of successful evacuation of an injured skier from the slopes to a first aid station are both unlikely. Two other safety-oriented activities of note are those of the National Ski Areas Association and the American Society for Testing and Materials (ASTM). The major emphasis of the activities of the former has been on the reduction of injuries associated with use of uphill transportation equipment. Because of this organization's efforts, severe, although seldom occurring, lift-related injuries have been greatly reduced in number. Uphill transportation facilities continue to account for between 5 and 10 percent of all reported ski injuries, but most of these injuries, however, are the result of skier ineptitude. Assistance to skiers loading and unloading from uphill transportation equipment and efforts to instruct neophyte skiers in the use of equipment are both reducing the number of injuries to those skiers.

It is possible for the leader of a group of young skiers to assume some responsibility for reducing risk of injury of this sort by making area management aware of the presence of the group which will often bring the response of the area manager alerting lift crews to the presence of these skiers and by making the skiers aware of the availability of assistance.

The activities of the ASTM F8.14 Subcommittee on Skiing Safety have focused on establishing standards for the construction of ski equipment and its installation and maintenance. While the ability of some types of bindings, for example, to reduce risk of injury is debatable, there is no doubt that failure to meet standards for installation will increase risk of injury associated with that equipment. This ASTM Subcommittee directs much of its effort to reducing these problems. Another problem associated with ski equipment is that many boots and bindings are incompatible with each other in that some boot sole and toe configurations reduce the release potential of some bindings. Another of the goals of the ASTM F8.14 Subcommittee is to standardize boot sole configuration so the problems of incompatibility will be eliminated.

The ski industry can do only so much in reducing risk of injury in skiing. Most of the responsibility for reducing the possibilities of injury rests with the individual skier. At present the most effective deterrent to ski injuries is an increase of skiing ability. This is particularly true for the beginning or novice skier. Instruction provides the most effective avenue for the neophyte skier to increase ability. A group which has done much to raise the overall ability of the skiing public is the Professional Ski Instructors of America (PSIA). By establishing uniform ski instruction techniques throughout the country the PSIA has made it possible for a skier to enjoy a continuum of ski instruction in most situations regardless of the area in which he skis. Most successful programs for young skiers have as an integral part regular instruction from ski schools with PSIA affiliation.

It is unlikely that a large group of young skiers will go through a complete ski season without at least one of the skiers experiencing a significant injury. Therefore, both the skiers and the

individuals responsible for the group should have some awareness of measures to be taken in event that an injury occurs.

In most cases supervisory people will not be at the injury site when it occurs. If skiers are urged not to ski alone, a practice which occasionally turns minor injuries into fatalities, one of the uninjured skiers can seek ski patrol assistance for the victim when an injury occurs. The injured skier should be allowed to lie where he has fallen. If a ski remains attached to the boot on an injured limb it should be removed only if it is causing pain, and if it can be accomplished without causing additional discomfort to the skier. All movement of the injured skier and his equipment should be left to the ski patrol after its arrival. Not only are they trained in first aid, but they are also skilled in handling injuries in the potentially awkward environment of the snow covered ski slope. After the victim has been transported to the ski patrol facility or the ski area clinic and first aid has been provided, it is usually necessary to transport the injured skier to his home or a more complete medical center. Ski injuries should be treated as soon as possible. The injured skier should not have to wait hours for the return trip on the ski club bus. In most cases automobiles are available and the back seat of a car will serve adequately for transportation. Nevertheless, transportation by ambulance should not be ruled out in cases where it is apparently necessary.

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Chapter 8

SNOWMOBILING

Henry V. Ziminski
United States Forestry Service

In 10 years, 2.5 million snowmobiles have been produced and are in the hands of users today. (2) There are over 400 active snowmobile clubs in existence.

Snowmobiles have a wide appeal. For winter recreation, they are used for cross-country touring, camping, rallies, racing, skijoring, ice fishing, hunting, sightseeing, and general snow play. The family is a most important segment of users. Many families have more than one snowmobile with preteen as well as adult members using machines. Age and poor physical condition of an individual need not be a deterrent. Even those persons who lack stamina for downhill or cross-country skiing, or who are physically handicapped, can enjoy snowmobiling in certain circumstances.

The appeal of the snowmobile is its ease of operation, its speed, and mobility. Depending on engine size, stock models of snowmobiles are capable of speeds over 50 miles per hour. Racing vehicles can travel much faster. Such speeds enable operators to travel long distances into isolated country in a short time.

To facilitate enjoyment of the sport, land management agencies administering county and state forests and parks, national forests, national parks and national resource lands, and industrial forest owners have designed and laid out many miles of trails. A uniform trail sign system has been in effect on most public and industrial forest lands. To provide a safer sport, public agencies have adopted a safety code and a code of ethics which have been disseminated by way of brochures and manufacturers' safety manuals together with other recommended safety measures.

Hazards

Hazards of this sport can be grouped into three classes: the machine, the recreational environment, and the sport participants.

The machine. Snowmobiles are well engineered machines. Though they are deceptively simple because of their comparatively small size and ease of operation, snowmobiles demand the respect of a complicated machine. Snowmobiles have a tendency to tip on rough terrain and sidehills. Their open construction makes riders vulnerable to injury from collision or low hanging branches or other obstacles.

Snowmobiles can tow toboggans or trailer sleds designed for hauling extra passengers or supplies. The safety designed trailer sleds have rigid tow bars to prevent tailgate collisions and to provide better control on turns. Unlike car brakes that depend on the pavement for friction, snowmobile brakes are designed to slow down the machine rather than stop it suddenly.

Improved muffler systems have reduced the noise level of the newest models of machines. However, over 1 million machines manufactured prior to 1971 are presently being used and are known to produce noise levels unsafe for the hearing of operators. (2: 147)

The recreational environment. Snowmobiling is done in a variety of environments: rural and urban areas, open fields, meadows, and forests; over flat and rough terrain; and in isolated country. Snowmobilers enjoy their sport on unplowed roads, mountain valleys and frozen swamplands, rivers and lake surfaces. The sport is popular at night as well as during the day.

Snowmobiles travel best on flat terrain, while they can travel over short pitches, the average machines are incapable of traveling over long steep grades especially in loose snow. Deep snow will mire a machine, requiring considerable physical exertion to free it. Snowmobiles, like all machines, are subject to breakdowns. Inability to perform repairs or to find one's way through isolated country may leave passengers vulnerable to the effects of exposure.

One factor common to all snowmobiling is cold weather. Rapid speeds expose passengers to high wind chill factors and dangers of frostbite and hypothermia. Machine breakdowns in deep snow make walking almost impossible unless passengers are equipped with snowshoes. Spending the night under survival conditions is a possibility. In many mountain canyons, there is danger from avalanches. Unexpected snowstorms may cause a group to become lost.

Ice travel is one of the most hazardous of snowmobile operations. Drownings as a result of breaking through the ice are one of the leading fatalities while snowmobiling. (2:132) Slush which is often present on lake surfaces underneath a layer of snow will stop a machine quicker than snow.

Snow blindness, another potential hazard, is caused by the glare of sunlight on snow. This danger increases in late winter months when thawing leaves a glaze on the snow.

The user. Snowmobilers can be a hazard to themselves and others. Some dangerous practices include: operating machines at speeds excessive for the terrain; careless operation; failure to recognize hazards and heed warnings; and permitting children to operate machines without adequate supervision or training. Inadequate first aid training and supplies can complicate injuries which might occur. Insufficient preparation for a trip by failing to obtain adequate maps, compass, information on conditions concerning the planned route, and failing to notify others of the intended itinerary are other contributing factors.

Hazard Reduction

Snowmobiling as a sport has become well established over the past 15 years. Reliable comprehensive data on accidents and injuries related to this sport are not available. There is no established system for reporting accidents involving snowmobiles unless they are involved on highways. Through a newspaper clipping surveillance program, the National Safety Council has been gathering statistics on deaths associated with snowmobiles. The most numerous deaths were the result of drowning, collisions with other vehicles, and collisions with fixed objects, including falls.

Snowmobile operators can do little to change the terrain, snow conditions, and weather; but, by taking necessary precautions, they can minimize hazards and injuries.

The machine. Snowmobile manufacturers are concerned with safety. Despite engineered simplicity of control and handling, basic owner training is necessary for safe operation. For safe and efficient operation of the vehicle, the operator should become thoroughly familiar with the owner's manual before starting the machine for the first time. Operators should know as much as possible about mechanical operation and maintenance. Maintenance is extremely important for peak performance of the machine.

Difficult maneuvers should not be attempted until an operator is thoroughly familiar with its operation. Only through conscientious practice can an operator learn the limitations of a snowmobile under different field conditions, its capabilities in different types of snow and snow depths, its turning characteristics, and what precautions are necessary for slopes and rough terrain. It is important to know the cruising range of the machine and provide extra fuel when necessary. All users must realize that by covering long distances in a short time they will

soon be in isolated country and thus potential victims of the weather, if engine failure occurs.

Common sense should be used at all times. Hot-rodding and jumping are for specially trained and experienced racers. Control of the machine is a primary necessity. Excessive speed can result in an upset or collision with other vehicles or objects. Reduced visibility at night calls for slower speeds.

Parents must be the judge of their children's ability to understand and control the power of a snowmobile. Parents have the responsibility to train youngsters in the safe operation of the vehicle and must instill a sense of responsibility in them.

Many safe automobile driving practices are applicable in snowmobiling. These are: maintain safe distances between machines, reduce speed in making tight turns and make a cautious approach to highway crossings or to other trails. Driving on highway rights-of-way open to snowmobiles is not encouraged, particularly at night when automobile drivers can be confused by snowmobile headlights.

Trip planning. For long trips or overnight camping trips, several precautions are suggested. A definite travel route should be planned. Family, friends, or other concerned parties should be informed of the intended route and time of expected return. Obtain maps of the territory for which the trip is planned, as well as information on trail locations, avalanche hazards, and if in lake country determine where unsafe ice or slush conditions can be expected. Travel over ice on lakes and streams only when certain their surfaces are safe. On long trips, the "buddy system" of two or more machines is advisable. Advance weather forecasts are essential to reduce the chance of isolation because of storms and to determine expected wind chill temperatures. Whenever possible someone trained in first aid techniques should be in the party.

Equipment and supplies. An emergency tool kit is a necessity. Recommended basic components include a set of gapped spark plugs, extra drive belts, plug wrench, pliers, screwdriver, friction tape, flashlight, flares, owner's manual, and towrope.

Other essentials include a compass, matches in a waterproof container, axe, extra fuel, snowshoes for each passenger, dehydrated emergency rations, a small kettle, space type blankets, small tarpaulin, folding shovel, and a lightweight block and tackle to free machines stuck in deep snow. Any or all of these pieces of equipment could save a life.

Clothing. A most important factor for enjoyment is adequate clothing. Good quality thermal or wool-cotton mixture underwear is essential. Outer clothing should be light, warm, windproof, and flexible so as not to impede movement. A wool shirt or turtle neck sweater under an insulated windbreaker jacket, along with wind resistant wool or insulated pants, make a good combination. Special one-piece suits designed for snowmobiling are available on the market.

Thermal boots, or leather-top rubber pacs with felt inner boots, and two pairs of socks are excellent for keeping the feet warm. Fleece lined, insulated leather mittens, or deerhide chopper's mitts with wool liners are better than gloves.

Use a warm cap for head protection. For extreme cold, a wool face mask should be worn. Tinted, shatterproof goggles reduce glare and are effective in cold weather operation. A snowmobile safety helmet should be worn when traveling through heavily wooded areas or whenever there is high risk in order to prevent possible head injury.

Hearing protection. All snowmobiles, sold by manufacturers, are equipped with exhaust mufflers. While noise pollution has been significantly reduced, operators are exposed to higher noise levels than can be tolerated. The limited amount of research data available certainly indicates that a significant portion of the snowmobiling population will be exposed to sound levels that could cause damage to their hearing (3:22). Some form of hearing protection is necessary. Helmets are certainly appropriate headgear for operators of snowmobiles. However, they are not effective hearing protectors (4:2). Expandable foam ear plugs, premolded rubber and special waxed cotton plugs provide excellent protection. The foam plugs easily conform to any ear size and form a complete seal. Plain cotton or cigarette filters are worthless.

When helmets are not used or required, then muff-type protectors, although less comfortable and somewhat inconvenient, will provide adequate protection.

Survival precautions. Becoming lost or experiencing equipment failure can require persons to spend a night out under severe weather conditions. *Don't panic*, is the first rule. Keeping warm is crucial, a plentiful wood supply and the ability to light and keep a fire going are essential. Wind shelters, using a tarpaulin, poles, evergreen boughs and piling up snow, can be built to break the wind. Construction of a snow cave is another possibility. Food and energy should be conserved. Walking out at night generally should not be attempted, even if snowshoes are available.

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Chapter 9

RECREATIONAL MOTORCYCLING

A. E. "Joe" Florio
University of Illinois

The rapid increase in popularity of motorcycles during the last few years is directly due to greater acceptance by the American motorist. The increased use of the motorcycle as a means of transportation and touring has reached a new peak of popularity in this country. This increased use of the motorcycle as a means of transportation has caused an increase in its use for sport and recreational cycling.

Although the motorcycle has been a popular form of motorized transportation and recreation in Europe and Asia for decades, its acceptance in this country is a fairly recent phenomenon. (37) The estimated number of cycles registered in the United States is now over 5,000,000. Experts predict that this number could double by 1980. The motorcycle has become popular because of its low cost, the relative prosperity of the times, the large teenage population, the move to suburbia, and increased leisure time. This last factor has greatly influenced the development of recreational, trail, and sports cycling. The development of low cost, special-geared trail machines allows fishermen, hunters, explorers, rock enthusiasts, and nature lovers to reach their destinations with an ease and speed that only a helicopter could surpass. Many of these new, light, compact machines can be carried on a car bumper or in a station wagon, trailer, camper, or small boat, yet they can transport a rider and a heavy load over the roughest terrain.

Regardless of why a motorcycle is to be ridden, adequate initial instruction in vehicle operation and development of good riding and driving habits must be accomplished. It is essential that good habits be formed early, as it is difficult to break habits once they are developed, whether good or bad. The development and retention of good driving habits will help insure fullest enjoyment of recreational motorcycling.

Dangers of Motorcycling

Although thousands of motorcyclists have enjoyed sports cycling without serious injury, a motorcycle is a potentially dangerous piece of equipment, if used improperly. The following statistics bear this out. Motorcycle accidental deaths have risen from 1,118 in 1964 to 3,160 in 1974. "The mileage death rate for motorcycle riders during 1974 is estimated to be about 14 (deaths per 100,000,000 miles of motorcycle travel). Based on data collected by the Federal Highway Administration, the 1974 rate represents a decrease from the 1973 rate of 16. The motorcycle death rate of 14 compares with the overall motor vehicle death rate of 3.6 which includes pedestrians. (28:56) In approximately 90 percent of motorcycle accidents, death or injury results. Collision with another motor vehicle is the predominant type of motorcycle accident. The great majority of motorcycle operators involved in accidents are under 25 years of age. There is no question as to the appeal which the cycle has for the teenager and young adult.

The major contributing circumstances found in motorcycle accidents is the human behavior involved (81 percent) rather than the environment or vehicle condition. The most frequent causes of motorcycle accidents are reckless driving, speeding, and failure to yield the right of way. Studies have also shown that motorcycle accidents are more the fault of automobile drivers than motorcyclists. Because many motorcycle accidents occur on weekends and during the summer months, it is fair to assume that most cycling is of a recreational nature.

Basic Skills

Recreational cycling takes place in parks and on boulevards in our cities, and can be enjoyed in mountain terrain on the trails of our forest preserves, state and national parks, and industrial forests. Regardless of the type of motorcycling one does, the cyclist should be skilled, courteous, and sportsmanlike. The skilled driver has developed competencies that allow him to drive safely in all situations. Basic skills and knowledge necessary to ride safely include the following:

1. Care and maintenance of
   a. lights and horn
   b. tight nuts and bolts
   c. tires (properly inflated and proper tread)
   d. front and rear brakes
   e. chain (properly adjusted and lubricated)
   f. cables
   g. engine and transmission
   h. battery
   i. oil and fuel levels
2. Proper dress
   a. protective helmet (full helmet provides the greatest protection)
   b. footwear (hightop boots or shoes with firm ankle support)
   c. clothing (bright colors and heavy material such as leather provides greatest protection. Increased visibility in traffic can be obtained by using strips of reflecting material on the jacket and gloves.)
   d. eye protection (goggles or face shield constructed of shatterproof material)
   e. gloves (gauntlet type cuffs)
3. Skills in
   a. operating the controls
   b. starting and stopping
   c. riding in various gear positions
   d. braking (front and rear)
   e. turning and cornering
   f. giving signals (hand or mechanical)
   g. driving on all kinds of road surfaces
   h. driving in all types of traffic situations
   i. following and overtaking
   j. maintaining proper lane position
   k. night driving, riding in adverse conditions and various wind conditions
   l. group riding

The preceding knowledges and skills, coupled with experience, can provide enjoyable recreational motorcycling.

Trail Riding

Trail riding is one of the most popular types of recreational or sports cycling. Riding on a paved surface is easier than riding on an unpaved trail. "Dirt" riding requires different techniques than "road" riding and requires different and heavier-duty equipment. Usually, the lightweight trail bikes are easier and safer to handle in dirt and sand than are the heavyweights. Trail bikes are different in that they have special tires with different tread designs for traction in sand and dirt. They also have heavier-duty springs and suspension systems to accomodate the pounding they get from the rugged terrain. Handlebars are usually wider for greater steering leverage. The brakes are less powerful than a street cycle to reduce the chance of locking wheels on loose surfaces. The engine supplies more power at low speeds for hill climbing. Trail cycles are not built to stop as quickly as street machines, and the knobby tires do not hold a paved surface well. Among the skills needed for trail riding are knowing how to ride in soft sand, mud, gravel, and up and down steep hills, uneven terrain and crossing ditches. Before one attempts serious trail riding, he should gain experience gradually in gentle terrain until he can handle the cycle under the various conditions he will encounter on an extended trail riding trip.

Additional tips for trailsters are:

1. Do not ride alone.
2. Check weather conditions.
3. Check with forest rangers.
4. Observe all conservation, fire, and litter regulations.
5. Obtain permission before riding on private property.
6. Respect signs, fences, and gates.
7. Respect animal life, wild or domestic.
8. Respect a horse pack train or people on horseback; turn off your motor and wait until they have passed. Remember, their mounts are not as manageable as yours.
9. Avoid riding in areas which could be damaged by your vehicle, such as soft meadows, areas with loose topsoil, and particularly steep hillsides where erosion might occur.
10. Be careful with firearms and never shoot at game while astride the machine. It is not only dangerous, but it is illegal in many states.
11. When riding in forests or on grass covered lands, be sure a spark arrestor is attached to the exhaust system.
12. Respect restricted areas such as slide areas, watersheds, high-risk fire areas, freshly seeded ranges, some national and state parks, and horse trails.
13. Carry a few important tools with which to repair the machine. Carry them in a tool box or in a packet fastened to the carrier or bars.

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Chapter 10

DEVELOPMENTAL AND PLAY ACTIVITIES

Anita Aldrich
Indiana University

Consider the factors that shape the personality of a child — his experiences, abilities, interests, attitudes, and other traits. Developmental and play experiences assist in stimulating the child to perceive and later to develop concepts. If he is to understand the world in which he lives he must explore actively his environment so he can organize and reorganize visual, auditory, and tactile impressions.

The anticipation of the interests and needs of preschool and primary school children of today must include familiarity with two media, water and weightlessness. One of these is neglected in the present education of the child and the other is not possible in the educational system of today. Very young children must be taught security in many different media and the safety procedures which lead to such security. These children will become adults who participate in leisure activities or professional endeavors which necessitate security in weightlessness. Until equipment and apparatus in preschool and elementary environments allow simulation of such weightlessness, teaching safety procedures of these experiences will be very difficult; but it behooves physical educators to develop some teaching progressions and knowledge of safety procedures for application in environments such as water and air.

Play is an environment in which a child becomes involved totally. He moves, he feels, he thinks, he acts, and he reacts to this situation. Because a child is receptive to play and possesses the potential for mastering neuromuscular skills early in his childhood, his elementary school years should be replete with movement experiences. The program in physical education should make children desire to develop physically, mentally, and socially to their maximum potential. It should also motivate them to evaluate themselves and others, make comparisons, and draw conclusions.

Safe ways of moving individually, with groups, and with objects are a part of good teaching. Proper footgear, such as rubber-soled and heeled shoes, may be instrumental in the prevention of accidents; socks without shoes increase hazards. Skill, knowledge, physical poise, experience, and consideration for others are the foundations of safe movement. As children learn how to take turns, to use apparatus and objects, and to adjust to moving with each other, they learn to be courteous and to avoid careless behavior, thus preventing accidents. In addition, varied experiences assist them in mastering the concept of their bodies moving through space and the relationship of their bodies to objects in space, some stationary, as well as some objects that are moving through space. Consistent safety instruction will teach children not to take chances. They will learn their capabilities, and learn not to be pressured to exceed their limitations. As they develop physically and emotionally, intelligent caution will allow them to proceed to the next level of achievement using the safety practices previously employed. An infant may crawl in various directions or roll from side to side, then onto his knees and one arm. This rolling may be accompanied by kicking one leg or both legs, swinging his arms, or rolling his head. Of course, the area must be cleared of obstruction to avoid collisions.

Moving in such patterns requires the child to be aware of where he is in space. He must develop a sense of direction. The movement of rolling may temporarily disturb the sense of balance. Seeing the world from a different angle than it appears from an upright position creates a sensation of confusion or being lost in one's environment. The child who is rolling, kicking, and swinging his arms must repeat the activity a sufficient number of times until he can quickly regain his balance and sense of orientation. Certainly if many children are moving in various directions, in various ways simultaneously, each must consider others. Not only must all the children control their bodies for their personal satisfaction but they must not infringe upon the rights of others, their spaces, and their movements, if all are to be safe and fair to one another.

Self discipline must be a part of teaching combinations of motor skills and refining motor skills with preschool and elementary children. Self discipline is many faceted. Control of strength, of speed, and weight are an adjunct to safety just as is control of one's emotions an adjunct to mental health, or one's self discipline an adjunct to functioning in a social unit. One cannot master an environment in which one or more people are involved unless he first masters himself.

Movements Involving Others

Children in the primary levels of school are adjusting to one another in classrooms, on the playground, and in the gymnasium. Some aggressiveness is necessary. Children should be given experiences in movements which involve moving with others, in opposition to others, and spacing themselves with others to avoid physical contact. Experiences should be pleasurable and foster cooperation, competition, self-discipline, and mental and physiological effort. Movements involving others may be an end in themselves or lead to structured games, rhythms, and self-testing activities. Dual movements range from quiet games such as jacks and hopscotch to more active games such as jump rope, tetherball, and stunts and tumbling.

As children move in opposition to one another, as in tug-of-war, or coordinate their efforts, as in leap frog, they become aware of each other's movements. This awareness and body control lead to safe play. It is important for all children to learn to dodge. This may entail dodging stationary objects or persons to prevent colliding, or it may necessitate dodging moving objects or persons. Quick reactions and movements needed for dodging are especially important to the safety of individuals if the space is limited by immovable boundaries or by limitations imposed by rules. Children also must be given experiences necessitating stepping over, jumping over or maneuvering around obstacles. These experiences should be introduced by requiring movement at a slow speed. As the participants become increasingly agile and body control improves the rate of speed for completing the tasks should be increased. Children will soon recognize that space is related to the rate of speed and that their safety and the safety of others is dependent upon control of their bodies in terms of force and direction.

It has been said, play is a child's work. Work in the adult world demands acceptance of responsibility, responsibility for self as well as others. A large part of the responsibility of play is safety; the observance of safety rules applied to one's self as well as the rules which result in a safe environment for others. Just as rules of etiquette are nothing more than consideration for others so are rules of safety consideration and courtesy to others.

Movements Involving Objects

Objects, when combined with movement and used with understanding and purpose, become learning tools for a child. In the early stages of learning to manipulate objects, the objects dictate the movement. Lightweight objects such as utility balls should be used initially to prevent injury. The child is taught to keep his eyes on the object and to be ready to move in any direction to catch the object or to avoid being hit by it. As a child becomes increasingly skilled and develops concepts of the relationship between himself and objects; his movements control the objects.

Tetherball is a prime example of a game requiring complex movement reactions to an object. The ball, because of its shape and size behaves in various ways when struck. In addition, the ball is attached to a rope which causes it to move in a circular pattern around the pole. As children strike the ball, its patterns of flight are changed. These variables require physical and mental alertness for effective and safe movement.

Movements Involving Combinations of Self, Others, and Objects

Movements involving self, others, and objects should afford children challenges, pleasures and problems for solving. Solutions to the problems should lie in skills both in breadth and depth, and insights into relationships of problems previously experienced. Relays may incorporate complex movements involving several people and objects of different sizes, weights, and shapes. Team effort is necessary for success. In a situation where several objects of varying sizes, shapes and weights are passed over the head, under the legs and to the side in alternating patterns, team members must follow the rules and move efficiently and rapidly, staying in their own lines and maintaining a safe distance from the person in front of them.

Combining one's movements with other individuals and with objects is not confined to games. Folk dancing may involve individuals manipulating objects separately or in unison, as well as moving in relation to other people, and learning spatial relationships. Children's ability to move the body to a rhythmical beat while simultaneously manipulating scarves, balloons, a parachute or other objects increases the difficulty and adds to the pleasure of moving.

As motor skills improve and children become increasingly mature, they begin to enjoy the complexities of safe movement which increased numbers of people and objects afford.

Movement Exploration

Movement exploration implies searching, re-examining, or discovering through the use of the body in relation to time, space, motion, and objects. It begins in infancy when the child starts to kick, move his head, and discover parts of his body. As a child's knowledge increases, he learns that the body has a system of levers and weights which can be handled to maintain balance, shift weight and produce force.

By the time a child starts to school he is able to execute locomotor movements and many non-locomotor (i.e. stationary) movements. He learns he can vary both of these types of movements, he learns ways in which he can communicate emotions, ideas, and feelings with his body. He may assume the role of a figure skater, or a lonely man or pretend that he is walking in the mud or that he is a large, angry animal.

As the locomotor and non-locomotor movements are combined and refined the child must learn to judge speed and space and to foresee obstacles as hazards. For instance, he must realize that in throwing an object, a reasonable distance between the thrower and catcher is necessary so the catcher will be successful and at the same time be able to prevent the object from hitting him. In executing locomotor movements involving speed, such as running from one place to another, imaginary stopping points or even lines should be established rather than allowing a child to run to a wall, a fence or a curbing. Bases should be flat and as close to the floor or ground as possible. Rocks, boards or sacks filled with sand or a similar substance are inappropriate for use. Ropes, hoops, equipment for crawling on, over, under or through are tools to be used in exploring movements using the whole body or parts of it. Care must be exercised when suggesting to the child, feelings, sensations, or images he may experience as he explores. His reactions to varying situations such as limited space in which to crawl, dim light or unnatural environment may minimize his pleasure as well as his safety or the safety of others.

The more proficient the young child becomes in motor skills the more the hazards in moving are reduced. Efficiency in movement is dependent upon correct movement patterns, consequently as the mistakes are reduced, the hazards are reduced.

Rhythmic Activity

Rhythm is the very essence of physiological existence. The heart beats rhythmically, the eyelids move rhythmically, and breathing is based upon rhythmical stimulation. Space, force, and time are common to both movement exploration and rhythm. Among the needs of children are those involving the combining of movements with rhythmic skills.

The element of space includes many movement possibilities. A child may walk forward, sideward, or in a circle; his movements may be big or little, narrow or wide. Time gives variations to a walk. A child may move at a slow, medium, or fast rate of speed. As he walks he may apply force in light, heavy, relaxed, or sudden steps, controlling his movements to avoid contact.

In introducing rhythmic activity to children, musical games can be incorporated. The games may involve responses to words or signals which require a change of direction or of body shape. Because children identify with their environment they like to be or do things with which they are familiar, such as being an airplane or mowing the lawn.

Most children can execute fundamental steps (i.e., walk, run, hop, and jump) before they begin school. These steps can be combined into a pattern. For example, a walk (step) and a hop executed on first one foot then the other become a skip; the gallop is a combination of a walk and a run using a step-together pattern. A sideward gallop may be interpreted as a *slide* to children. Most pattern dances such as a polka, schottische, or mazurka are built on a skip, gallop, or slide. These and other traditional dance steps, such as the two-step and waltz, are combinations of basic locomotor movements.

Rhythmic activities present unique problems in regard to safety. Often because the experiences are pleasurable and rhythms are characterized by many people as being less active than games or self-testing activities, children reach a level of fatigue at which point body control is lessened. If objects or obstacles are used as in some musical games the fatigue factor becomes even more important.

Rope jumping is a rhythmical activity. The crucial aspect of safety in this activity is in handling the rope. One child may jerk the rope through the hand of another. A child may be pulled off balance, or he may wrap the rope around one or more children. Definite guidelines for safe use of the ropes should be established incorporating suggestions for those using them so they will not be misused at the expense of the safety of others. The safe use of hoops require comparable guidelines.

Individual scarves or a parachute manipulated rhythmically and simultaneously by many children necessitate careful handling. A scarf can become a restraining device if it is used in that manner by one child applying it to another. Care should be taken that the activity with a scarf not involve wrapping it around one's eyes, nose or mouth. Each child should have his own scarf and retain it for his personal use.

Parachutes are made of nylon material which does not allow air to readily pass through the cloth. In rhythmical activities when children run under the parachute or reverse their hold on the chute so they are temporarily under it, time control is of the essence. The parachute should cover a child or the group only momentarily. When it is being folded to be stored it should not be walked upon. The material, spread on a surface such as wood or asphalt, creates a very slick condition.

Executing fundamental movements in either creative rhythms or pattern dances requires that the child maintain his sense of direction, his feeling for space and body control. Rapid circular movements require that a child establish a point of focus so he will not lose his equilibrium.

In one sense, all activity is rhythmic in nature. When movements are combined repeatedly in certain ways, patterns evolve. The impacts of moving safely alone, with a partner or with a group in rhythmic activity determines to a large degree the pleasure one accrues from these experiences.

Self-Testing Activities

Self-testing activities are those in which the emphasis is on individual improvement and accomplishment. Play activities of a self-testing nature appeal to a child because he receives satisfaction from relying upon himself to test his control over his environment and learns to recognize his strengths and weaknesses.

Many schools have self-testing programs in which test scores are compared with national, state, or local norms. The greatest value of comparison lies in individual appraisal. This program should be designed so that increasingly difficult problems in movement are provided for the child as soon as he accomplishes a less complex one.

Self-testing activities increase the child's awareness of his need for greater body control and improvement of his balance, timing, and coordination. He learns how to fall and land safely from a jump. Not only are personal potential and achievement recognized through these activities, but a child also learns appreciation for others' abilities. In tumbling he learns to assist others by *spotting* without injury to himself.

As a child is introduced to a new combination of skills, he should be taught the accompanying and appropriate safety rules and procedures. Such teaching provides for skills and safety to develop simultaneously and as skills become more proficient safety procedures become more habitual.

Games

Games provide recreation as well as educational values for children. Young children enjoy associating with other children, meeting the goal of the game, and coping with the complexity of the rules.

In selecting a game it is important to determine whether it can be adapted to the available space safely, whether it interests the children, provides vigorous activity and emotional release, offers experiences in social adjustment, requires strategy, and utilizes skills appropriate to the children's stage of motor development. Incorporated within the rules of the games, children play with such locomotor movements as chasing, tagging, throwing, batting, and kicking. It has been said that games are one of the richest environments for fostering aggressiveness. Children should be taught where to tag another and the force to be applied to prevent injury.

Very young children live in an "I" centered environment. When they enter school, it is necessary for them to become accustomed to a group situation so they may become a member of a "we" environment. Introductory games of circle and line formations provide an excellent setting for this transition. Gradually, children progress from solo and parallel playing to becoming a member of a group and feeling an allegiance to a team. Team games with a minimum of rules lead quickly to a spirit of cooperation. As games become more highly organized the need for discussion and strategy increases. Relays foster the team idea. Through them, a child can be taught that he is racing for the group or team to which he belongs while adhering to the rules, thus preventing injury and accidents.

Boys and girls at the intermediate level enjoy learning and participating in advanced team games. The games should be geared to require motor coordination, social intelligence, and self-discipline appropriate to their maturity. It is a fallacy for adults to insist upon regulation equipment, regulation playing courts or fields, and adult competitive standards. Not only could these practices be injurious to the safety of the immature child, but the majority of 9- to 11-year olds prefer equipment and rules which will allow them to use those skills and knowledges which their stage of development permits.

This phase of physical education provides an avenue for excellence in performance due to a continued refinement of skills as the child works toward mastering progressively complex movement patterns.

Activities Involving Playground Apparatus

No longer are haylofts available for children to enjoy. Trees in parks cannot be nurtured nor will they grow if children, as they climb them, break branches or skin the bark. Playground apparatus furnishes children with an opportunity to reach, bend, pull, swing, and climb in much the same way that haylofts and trees once did.

These activities develop the upper portion of the body, providing the child furnishes the movement. Apparatus which is developmental in nature includes horizontal bars and ladders, jungle gyms, and climbers. Once the equipment has been safely installed and is periodically tested, the burden of safety should be placed on the child when he is using the equipment; safety rules should be reduced to a minimum. The hand grip, the correct dismount, and the number of children using a single piece of apparatus should suffice for safe equipment use.

The safest hand grip is placing the fingers over the rungs of a piece of apparatus with the thumb under the rung and locked over the fingers. As the child walks the horizontal ladder with his hands, this grasp is a natural one as he reaches for the next rung. This grip also applies to climbing ropes or poles. In the use of swinging rings, climbing poles and ropes, children should be seated side by side facing the apparatus so they will be able to see the participant. There will not be an urge to crowd forward for one's turn and yet all will be a safe distance from the apparatus. Attempting to line children up one behind the other a safe distance directly behind a piece of apparatus is a futile attempt in teaching safety because the natural inclination is to move forward toward the focal point which is the swinging rings, the climbing ropes or climbing poles. Young children should be taught the ropes and poles are to be used only for climbing. The rings are for swinging. They are made to work by the child grasping one in each hand and running forward until his feet can no longer touch the floor, no other persons should propel a child who is swinging on the rings. Each type of apparatus should be considered as a unit confined to a designated area by virtue of how and where the apparatus will be used. A child should move from one unit to another by following certain lines of direction. He should walk from one place to another. He should never cut in front or behind a piece of apparatus that allows movement, such as the swinging rings. When children are first learning to rotate from one unit to another it is wise to have them all rotate at one time. The following diagram suggests a safe location and rotation pattern for those using climbing ropes, climbing poles, a folding horizontal ladder, swinging rings and stall bars. (See Figure 1)

The only difference in the hand grip in working the horizontal ladder and climbing the ropes or poles is that the hands are placed horizontally on the ladder while on the ropes and poles the hands are placed vertically.

The important aspect of dismounting from apparatus is the manner in which it is executed rather than the surface to which one dismounts. If a child drops carelessly from an apparatus because he thinks the surface will compensate for the poor dismount, injury may result. Sand, tan bark, or turf worn by use can cause a child to land off-balance when he dismounts. Too often a child uses a rubberized surface or mat under apparatus as a landing crutch. A correct dismount precludes the child's weight from going backward and assumes that his feet will land solidly in a parallel position. His hands should be in front of him in case he needs to touch them to the surface for balance.

A starting place painted on the apparatus or directional arrows on the surface under the apparatus will aid in equalizing the use of equipment as well as minimize the incidents of children approaching the apparatus in opposite directions.

Figure 2 suggests a plan for locating apparatus and indicates the line of direction to follow in moving from one piece of apparatus to the next. Note that the climbing apparatus is interspersed with apparatus from which a child can hang.

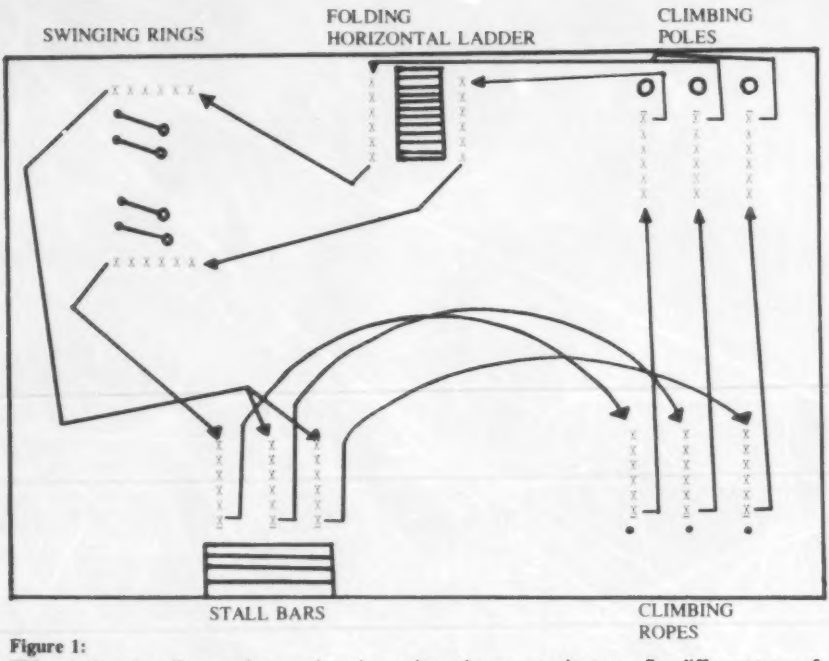

Figure 1:
This rotation plan allows each group in a class to have the opportunity to use five different types of suspended apparatus.

Summary

The safety factors involved must be considered in relationship to all movements. Children should develop attitudes that foster respect and consideration for others as they move and practice habits that will eliminate safety hazards for themselves and others. Children often have more courage than wisdom. They must exercise self-discipline and learn how to anticipate what may happen in various situations brought about by movement and how to react to these situations. Strength, coordination, agility, balance, and flexibility are essential if one is to move safely.

Living is an adventure, an exploration. Modern living presents increased hazards because of the movements of many people and objects of varying sizes, shapes, and speeds. If man is to move safely with the masses, he must first learn in his youth to move safely as an individual and then with groups in controlled environments.

Finally, one must have received the reception of stimuli and the deletion of inappropriate considerations to which he should respond if he is to remain safe in uncontrolled situations or fluid movements. Habits of safety responses are the result of a child learning the problem, learning what is expected of him in relation to the problem, being led to the solution of the problem and experiencing the reward of the solution without encountering safety hazards that are never identified, that are insurmountable, or that are never eliminated.

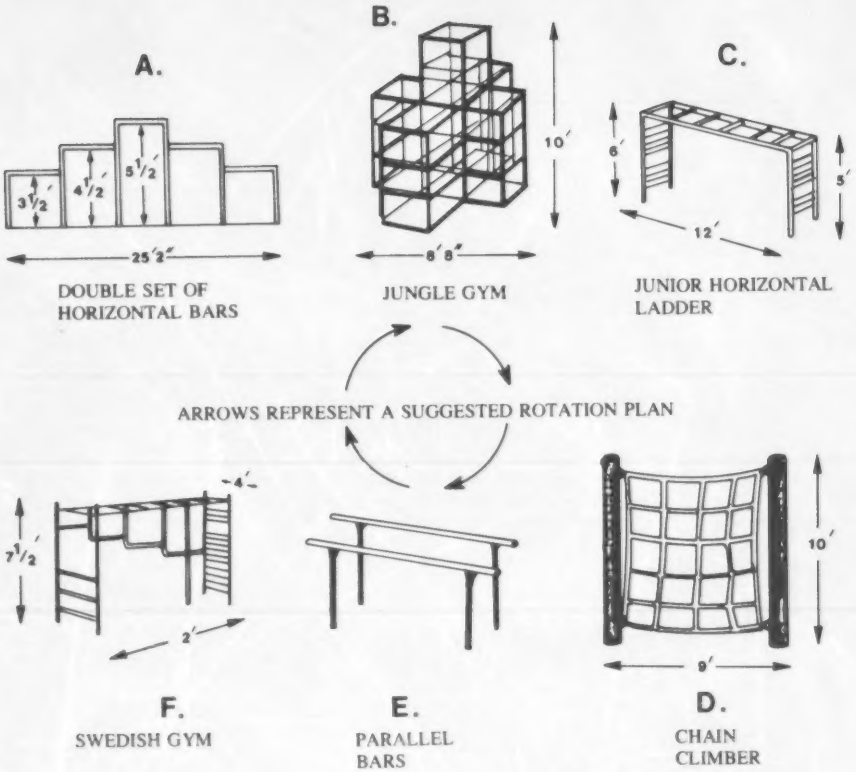

Figure 2: A plan for locating playground apparatus.

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